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STATEWIDE AIR EMISSIONS CALCULATIONS FROM WIND AND OTHER RENEWABLES

SUMMARY REPORT

A Report to the
Texas Commission on Environmental Quality
For the Period September 2009 – August 2010

TCEQ

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December 2010

ENERGY SYSTEMS LABORATORY

Texas Engineering Experiment Station
Texas A&M University System

ENERGY SYSTEMS LABORATORY
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3581 TAMU
College Station, Texas 77843-3581

December 10, 2010

Chairman Bryan W. Shaw, Ph.D.
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Dear Chairman Shaw:

The Energy Systems Laboratory (ESL) at the Texas Engineering Experiment Station of the Texas A&M University System is pleased to provide its third annual report, "Statewide Emissions Calculations From Wind and Other Renewables," as required by the 79th Legislature. This work has been performed through a contract with the Texas Environmental Research Consortium (TERC).

In this work the ESL is required to obtain input from public/private stakeholders, and develop and use a methodology to annually report the energy savings from Wind and Other Renewables. This report summarizes the work performed by the ESL on this project from September 2009 to August 2010.

Please contact me at (979) 845-1280 should you or any of the TCEQ staff have questions concerning this report or the work presently being done to quantify emissions reductions from energy efficiency and renewable energy measures as a result of the TERP implementation.

Sincerely,

David E. Claridge

David Claridge, P.E.
Director

Enclosure

cc: Commissioner Buddy Garcia
Commissioner Carlos Rubenstein
Executive Director Mark R. Vickery, P.G.

Disclaimer

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SUMMARY REPORT

Statewide Air Emissions Calculations from Wind and Other Renewables

1. EXECUTIVE SUMMARY

The 79th Legislature, through Senate Bill 20, House Bill 2481 and House Bill 2129, amended Senate Bill 5 to enhance its effectiveness by adding 5,880 MW of generating capacity from renewable energy technologies by 2015 and 500 MW from non-wind renewables.

This legislation also requires the Public Utilities Commission of Texas (PUCT) to establish a target of 10,000 megawatts of installed renewable capacity by 2025, and requires the Texas Commission on Environmental Quality (TCEQ) to develop methodology for computing emissions reductions from renewable energy initiatives and the associated credits. Table 1-1 lists the statutory mandates and total wind power generation capacity (including installed and announced) in Texas from 2001 to 2025. It shows that Texas will achieve its milestone of 12,000 MW by the end of 2010 according to the information from PUCT.

Table 1-1: Installed/Announced Wind Power Capacity and The Statutory Mandates

Installed and Announced		**SB20 Plan**	
Month-Yr	MW	Month-Yr	MW
Dec-2001	1,019		
Jan-2002	1,098		
Dec-2003	1,299		
Dec-2005	1,972		
Dec-2006	3,033	Jan-2007	2,280
Dec-2007	5,007		
Dec-2008	8,869	Jan-2009	3,272
Dec-2009	10,046		
Dec-2010	12,582	Jan-2011	4,264
Dec-2011	14,731		
Dec-2012	17,383		
Jun-2013	17,519	Jan-2013	5,256
		Jan-2015	**5,880**
		Jan-2025	**10,000**

In this Legislation the Energy Systems Laboratory (ESL) is to assist the TCEQ in quantifying emissions reductions credits from energy efficiency and renewable energy programs, through a contract with the Texas Environmental Research Consortium (TERC) to develop and annually calculate creditable emissions reductions from wind and other renewable energy resources for the State Implementation Plan (SIP).

The Energy Systems Laboratory, in fulfillment of its responsibilities under this Legislation, submits its third annual report, "Statewide Air Emissions Calculations from Wind and Other Renewables," to the Texas Commission on Environmental Quality.

The report is organized in several deliverables:

1. A Summary Report, which details the key areas of work;
2. Supporting Documentation; and
3. Supporting data files, including weather data, and wind production data, which have been assembled as part of the third year's effort.

This executive summary provides summaries of the key areas of accomplishment this year, including:

4. Continuation of stakeholder's meetings;

- Analysis of power generation from wind farms using improved method and 2008 data;
- Analysis of emissions reduction from wind farms;
- Updates on degradation analysis;
- Analysis of other renewables, including: PV, solar thermal, hydroelectric, geothermal and landfill gas;
- Review of electricity generation by renewable sources and transmission planning study reported by ERCOT;
- Review of combined heat and power projects in Texas; and
- Preliminary reporting of NOx emissions savings in the 2009 Integrated Savings report to the TCEQ.

1.1 Development of Stakeholder's meetings

Legislation passed during the regular session of the 79th Legislature directed the Energy Systems Laboratory to work with the TCEQ to develop a methodology for computing emissions reductions attributable to renewable energy and for the ESL to quantify the emissions reductions attributable to renewables for inclusion in the State Implementation Plan annually. HB 2921 directed the Texas Environmental Research Consortium (TERC) to engage the Texas Engineering Experiment Station for the development of this methodology.

During the 2009-2010 periods, Texas A&M held continuing Stakeholder's meetings and made several presentations to EPA, TCEQ and other interested parties regarding the analysis and the results.

1.2 Analysis of wind farms using an improved method and 2008 data

In this report, the weather normalization procedures developed together with the Stakeholders were presented and applied to all the wind farms that reported their data to ERCOT during the 2008 measurement period, together with wind data from the nearby NOAA weather stations. In the 2009 Wind and Renewables report to the TCEQ (Haberl et al. 2009), weather normalization analysis methods were reviewed; an analysis was refered to the last year report.

This report used the same analysis method as the one in the prior report (Sweetwater III as an example) to present the same weather normalization procedure, including the processing of weather and power generation data, modeling of daily power generation versus daily wind speed using the ASHRAE Inverse Model Toolkit (IMT) for two separate periods, i.e., Ozone Season Days period (OSP), from July 15 to September 15, and Non-Ozone Season days period (Non-OSP); prediction of 1999 wind power generation using developed coefficients from 2008 daily OSP and Non-OSP models; and the analysis on monthly capacity factors generated using the models.

Then, a summary of total predicted wind power production in the base year (1999) for all of the wind farms in the ERCOT region using the developed procedure is presented and the new wind farms which started operation in 2008 were added. Figure 1-1 shows the measured annual wind power generation in 2008 and the estimated wind power generation in 1999 using the developed method for each wind farm in the ERCOT region. The total measured wind power generation in 2008 is 14,621,494 MWh, which is 2% less than what the same wind farms would have produced in 1999. Figure 1-2 shows the same comparison but for the Ozone Season Period. The measured wind power generation in the OSP of 2008 is 24,536MWh/day, which is 16% lower than the estimated 1999 OSD wind production.

This report also includes an uncertainty analysis that was performed on all the daily regression models for the entire year and Ozone Season Period. The detailed analysis for each wind farm is provided in the

Appendix B to this report. The original data used in the analysis is included in the accompanying CD-ROM with this report.

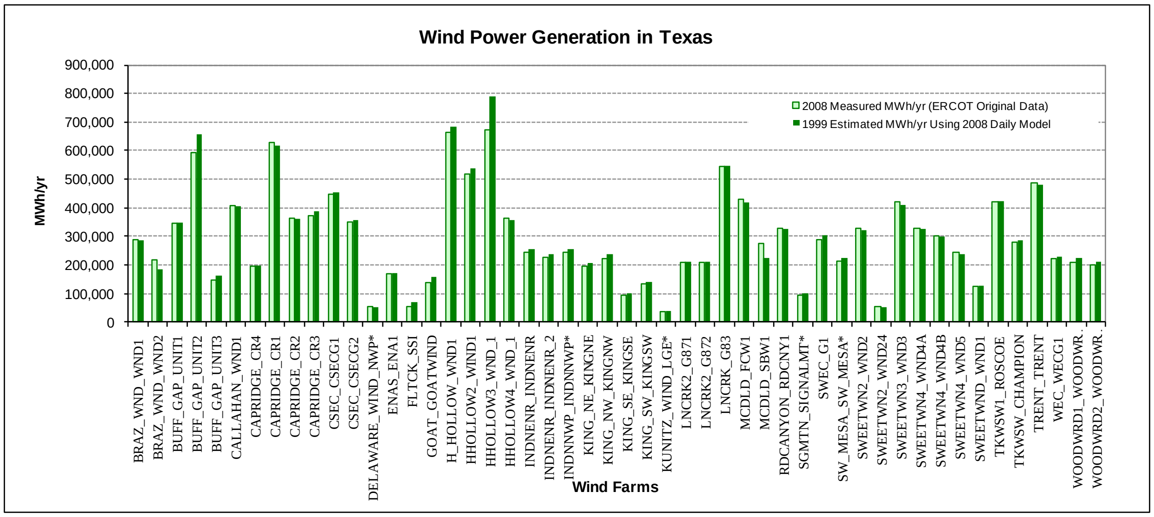

Figure 1-1: Comparison of 2008 Measured and 1999 Estimated Power Production for Each Wind Farm

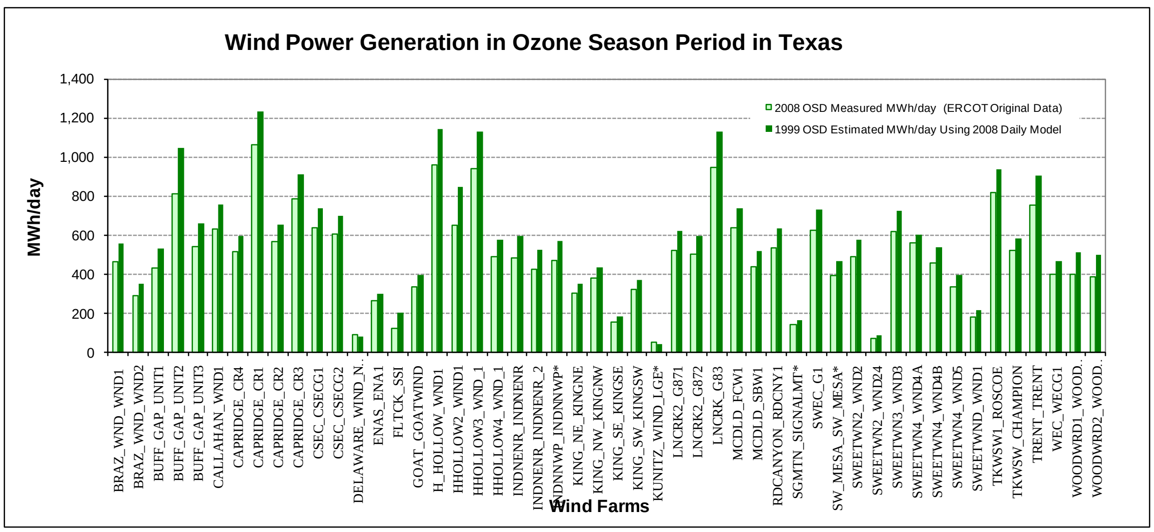

Figure 1-2: Comparison of 2008 OSD Measured and 1999 OSD Estimated Power Production for Each Wind Farm

1.3 Analysis of emissions reduction from wind farms

In this report, the procedure for calculating annual and peak-day, county-wide NOx reductions from electricity savings from wind projects implemented in the Power Control Areas in ERCOT listed in the EPA's eGRID was presented , including assigning the wind farms to PCA based on the information provided by the PUCT, and calculating the NOx emission reductions based on the special version of 2007 eGRID developed by the EPA for the TCEQ. According to the developed models, the total MWh savings in the base year 1999 for the wind farms within the ERCOT region are 18,808,351MWh and 41,403MWh/day in the Ozone Season Period. The total NOx emissions reductions across all the counties amount to 10957 tons/yr and 24 tons/day for the Ozone Season Period. Figure 1-3 and Figure 1-4 show the estimated emissions reductions from wind power in each county of Texas.

The ESL has been working with the EPA and TCEQ regarding a new version of eGRID for all ERCOT counties in Texas. A new version of eGRID was developed and presented in this report, which is based on the ERCOT congestion management zones. As the TCEQ moves the base year to more recent years, this updated version of eGRID, representing the current Texas market, may be used to estimate the emissions reduction from wind power in the next year's report.

Figure 1-3: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

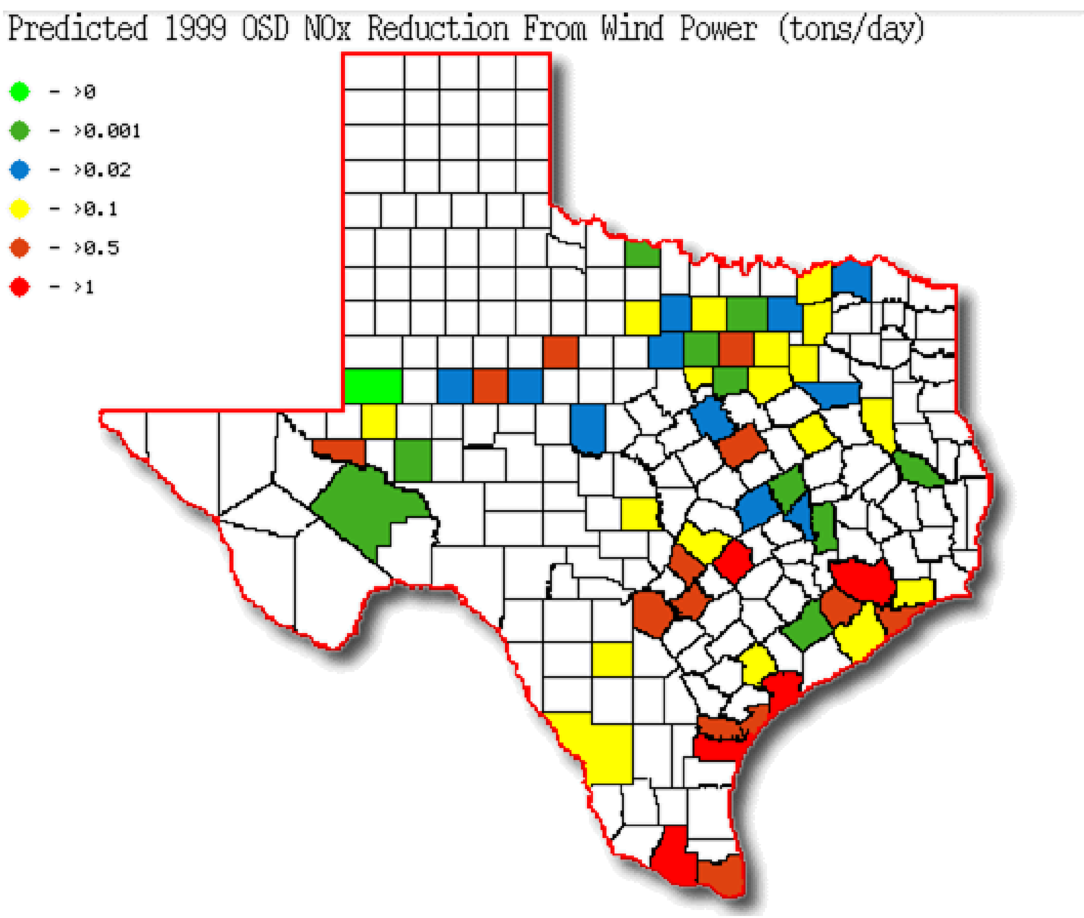

Figure 1-4: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

1.4 Development of a degradation analysis

This report contains an updated analysis to determine what amount of degradation could be observed in the measured power from Texas wind farms. Currently, the TCEQ uses a very conservative 5% degradation per year for the power output from a wind farm when making future projections from existing wind farms. Accordingly, the TCEQ asked the ESL to evaluate any observed degradation from the measured data for Texas wind farms. To accomplish this, nine wind farms (12 sites) from 2002 to 2008, two wind farms from 2004 to 2008 and four new wind farms from 2006 to 2008 (Buffalo Gap, Callahan Divide Wind, Horse Hollow Phase 1 and Sweetwater Wind 2) were evaluated with a total capacity of 1754.6 MW.

In this analysis, a sliding statistical index was established for each site that uses 10th, 25th, 50th, 75th, 90th, and 99th percentiles of the hourly power generation over a 12-month sliding period, as well as mean, minimum and maximum hourly power generation of the same 12-month period. These indices are then displayed using one data symbol for each 12-month slide, beginning from the first 12-month period until the last 12-month period for each of the wind farms.

As shown in Table 1-2, of the eighteen sites analyzed, thirteen sites showed an increase when one compares the 90th percentile of whole period to the 90th percentile of the first 12-month period, ranging from 1.5% to 27.3%. The remaining five sites showed a decrease from -1.2% to -23.7%. The weighted average of this increase across all wind farms studied is 10.3% (positive), which indicates that no degradation was observed from the aggregate energy production from these wind farms over the studied operation period.

Table 1-2: Summary of 90th Percentile Hourly Wind Power Analysis for Fourteen Wind Farms (18 Sites) in Texas

Wind Farm	First 12-mo 90th Percentile Hourly Wind Power		Average of the Sliding 12-mo 90th Precentile Hourly Wind Power		Minimum of the Sliding 12-mo 90th Precentile Hourly Wind Power		Maximum of the Sliding 12-mo 90th Precentile Hourly Wind Power		No. of Month of Data	Capacity (MW)
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Brazos Wind Ranch	Dec-04	127.5	133.3	4.5%	125.1	-1.9%	139.3	9.2%	60	160
Indian Mesa	Dec-02	48.0	55.9	16.5%	42.1	-12.2%	66.0	37.5%	84	82.5
Delaw are	Dec-02	18.5	18.8	1.5%	15.6	-15.5%	21.5	16.1%	84	28.5
Desert Sky	Dec-02	89.0	113.4	27.3%	83.1	-6.7%	134.4	50.9%	84	160
King Mountain-NE	Dec-02	41.8	46.5	11.1%	36.3	-13.2%	56.4	34.8%	84	79.3
King Mountain-NW	Dec-02	44.7	53.8	20.4%	40.2	-10.1%	65.3	46.1%	84	79.3
King Mountain-SE	Dec-02	21.6	23.2	7.2%	18.4	-15.0%	28.1	29.8%	84	40.3
King Mountain-SW	Dec-02	41.6	46.4	11.6%	38.4	-7.6%	53.4	28.5%	84	79.3
Sw eetw ater Wind 1	Dec-04	34.1	33.0	-3.1%	32.3	-5.0%	34.2	0.4%	60	37.5
Trent	Dec-02	108.8	126.2	15.9%	108.2	-0.6%	132.8	22.0%	84	150
Woodw ard	Dec-02	85.3	92.7	8.7%	80.4	-5.7%	109.7	28.6%	84	160
Kunitz	Dec-02	25.2	19.2	-23.7%	11.5	-54.5%	25.2	0.0%	84	35
Big Spring	Dec-02	27.2	25.4	-6.8%	23.9	-12.0%	27.2	0.0%	84	41
Southw est Mesa	Dec-02	51.1	49.2	-3.7%	38.5	-24.6%	56.5	10.6%	84	74.6
Buffalo Gap 1	Nov-06	100.9	99.6	-1.2%	97.9	-2.9%	102.8	1.9%	37	120
Callahan Divide Wind	Feb-06	93.3	98.8	5.8%	93.3	0.0%	101.5	8.8%	46	114
Horse Hollow Phase 1	Jun-06	157.0	168.2	7.2%	157.0	0.0%	177.3	12.9%	42	213
Sw eetw ater Wind 2	Jan-06	71.4	81.2	13.9%	71.4	0.0%	85.3	19.5%	47	100.3
Weighted Average:				**10.3%**		**-9.4%**		**26.3%**	**Total:**	**1754.6**

1.5 Analysis of other renewable source

Other renewable energy projects throughout the state of Texas were located to determine NOx emissions reduction and are included in this section. Searches were conducted on five specific categories which include solar photovoltaic, solar thermal, geothermal, hydroelectric, and Landfill Gas-Fired Power Plants. Many newly located renewable energy projects are assembled for inclusion in this report (Table 1-3).

Table 1-3: New Projects Reported in February 2010

S.No	Renewable Energy Source	No Of New Projects Reported in February 2010
1	Solar Photo-Voltaic	124
2	Solar Thermal	11
3	Land fill gas	0
4	Hydro-Electric	0
5	Geothermal	5

1.6 Review of electricity savings and transmission planning study reported by ERCOT

In this report, the information posted on ERCOT's Renewable Energy Credit Program site www.texasrenewables.com is reviewed. In particular, information posted under the "Public Reports" tab was downloaded and assembled into an appropriate format for review. This includes ERCOT's 2001 through 2009 reports to the Legislature and information from ERCOT's listing of REC generators.

Each year ERCOT is required to compile a list of grid-connected sources that generate electricity from renewable energy and report them to the Legislature. Table 1-4 contains the data reported by ERCOT from 2001- 2009. Figure 1-5 is included to better illustrate the annual data collected by ERCOT.

Table 1-4: Annual Electricity Generation by Renewable Resources (MWh, ERCOT: 2001 - 2009)

Technology Type	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Wind	565,597	2,451,484	2,515,482	3,209,629	4,221,568	6,530,928	9,351,168	16,286,440	20,595,989
Hydro	30,639	312,093	239,684	234,791	310,302	210,077	382,882	445,428	507,507
Landfill gas		29,412	154,206	203,443	213,777	306,087	356,339	386606	412,926
Biomass			39,496	36,940	58,637	60,569	54101	70,833	73,364
Solar		87	220	211	227	470	1,844	3,338	4,492
Totals	596,236	2,793,076	2,949,088	3,685,014	4,804,511	7,108,131	10,146,334	17,192,645	21,594,278

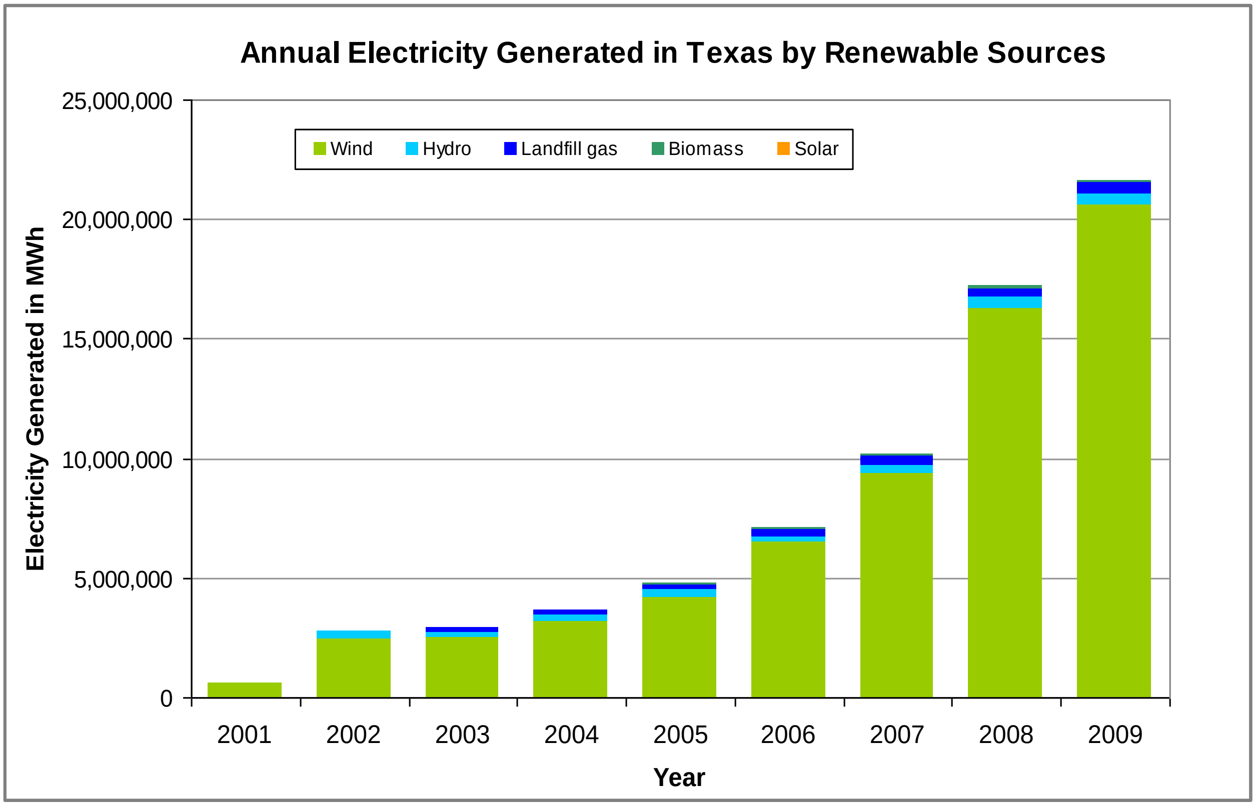

Figure 1-5: Electricity Generation by Renewable Resources (ERCOT: 2001 – 2009 Annual)

1.7 Preliminary reporting of NOx emissions savings in the 2008 Integrated Savings report to the TCEQ

In this preliminary report, the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day[1] (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

In 2009, the cumulative total annual electricity savings from all programs is 25,585,081 MWh/year (15,327 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 70,442 MWh/day, which would be a 2,935 MW average hourly load reduction during the OSD period (40.72 tons-NOx/day). By 2013, the total cumulative annual electricity savings from will be 31,979,929 MWh/year (19,314 tons-

[1] An ozone season day (OSD) represents the daily average emissions during the period that runs from mid-July to mid -September.

NOx/year). The total cumulative OSD electricity savings from all programs will be 92,099 MWh/day, which would be a 3,837 MW average hourly load reduction during the OSD period (54.15 tons-NOx/day).

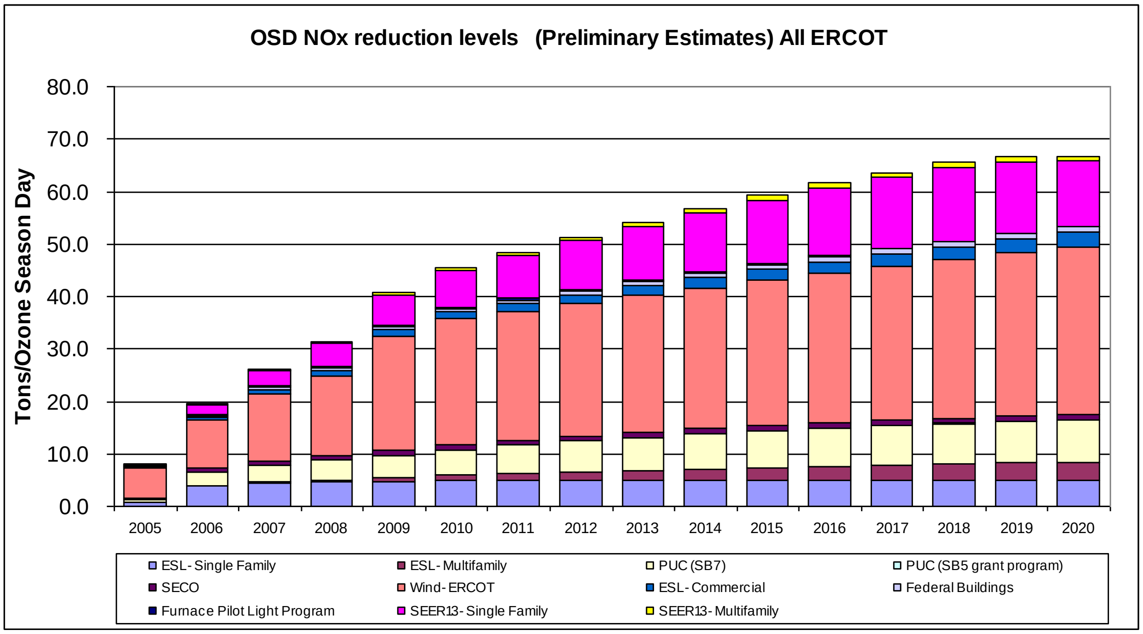

Figure 1-6: Cumulative OSD NOx Emissions Reduction Projections through 2020

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2 INTRODUCTION

2.1 Statement of Work for Calculations of Emissions from Wind and Other Renewables

This summary report covers the Energy Systems Laboratory's work from September 2009 through August 2010. This work is intended to cover the basic work outline included below:

Task 1: Obtain input from public/private stakeholders.

Task 2: Develop a methodology in cooperation with the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (US EPA) for calculating emissions reductions obtained through wind and other renewable energy resources in Texas.

Task 3: Calculate annual, creditable emissions reductions for wind and other renewable energy resources for inclusion in the State SIP.

Task 4: Include emissions reductions by county from wind and renewable energy resources in the ESL's annual report to the TCEQ.

Task 5: Incorporate wind and renewable energy emissions reductions as a component of the ESL's annual *Clean Air Through Energy Efficiency Conference (CATEE)* to facilitate technical transfer.

2.2 Summary of Progress

The progress toward completing each task is provided in the following section and throughout this report.

<u>Task 1: Obtain input from public/private stakeholders.</u>

Legislation passed during the regular session of the 79^{th} Legislature directed the Energy Systems Laboratory to work with the TCEQ to develop a methodology for computing emissions reductions attributable to renewable energy and for the ESL to quantify the emissions reductions attributable to renewables for inclusion in the State Implementation Plan annually. HB 2921 directed the Texas Environmental Research Consortium (TERC) to engage the Texas Engineering Experiment Station for the development of this methodology.

During the period from September 2009 to August 2010, several presentations were done to report the analysis methodology and the results with TCEQ, EPA, TCEQ, and other interested parties. Appendix A shows the slides that were presented in those meetings.

- March, 2009 – Presentation to the EPA sustainable Skylines about the quantification of energy and emissions saved in programs, Dallas, Texas.
- March, 2009 – Presentation to the Texas Senate and Energy Efficiency Committee about CO_2 Emissions Reduction Potential , Austin, Texas.
- July, 2009 – Presentation to the International Building Simulation Association (IBPSA) about the development of a web-based code-compliant 2001 IECC residential simulator, Glasgow, Scotland, Texas
- October, 2009 – Presentation at the CATEE conference about the quantification of energy and emissions saved in energy Efficiency/Renewable Energy (EE/RE) programs, Houston, Texas.

Task 2: Develop a methodology in cooperation with the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency for calculating emissions reductions obtained through wind and other renewable energy resources in Texas.

This task is composed of the following subtasks:

- Review existing methodologies for calculating emissions reductions from wind energy and other renewable energy systems with US EPA, TCEQ and stakeholders. Develop acceptable methodologies for wind and renewables.
- Determine how to implement methodologies for Texas, including accounting of current installations, future sites, degradation, discounting/uncertainty, grid constraints, etc.
- Review methodologies for verifying wind energy production and renewable energy installations with TCEQ, US EPA and stakeholders. Develop acceptable methodologies for verifying installations, including documentation, EPA QAPP, etc.
- Develop draft State Guidelines for the TCEQ for EE/RE SIP credits.

Task 3: Calculate annual, creditable emissions reductions for wind and other renewable energy resources for inclusion in the State SIP.

This task is composed of the following subtasks:

- Calculate annual emissions from wind and other renewable energy projects.
- Verify annual installations of wind and renewable energy systems in Texas.
- Verify ERCOT historical data for wind production and other renewables.

Task 4: Include emissions reductions by county from wind and renewable energy resources in the ESL's annual report to the TCEQ.

This task is composed of the following subtasks:

- Report annual emissions from wind and other renewable energy projects.
- Report on verification of installations of wind and renewable energy systems in Texas.
- Develop documentation for all methods developed.

Task 5: Incorporate wind and renewable energy emissions reductions as a component of the ESL's annual *Clean Air Through Energy Efficiency Conference (CATEE)* to facilitate technical transfer.

Additional information regarding the ESL's efforts on Tasks 2, 3, 4 and 5 are listed below and presented in detail in the following sections. This work was performed during the period September 2009 through August 2010.

- Analysis of wind farms using 2008 data;
- Analysis of emissions reduction from wind farms;
- Updates of the degradation analysis to include more wind farms;
- Analysis of other renewables;
- Review of electricity savings and transmission planning study reported by ERCOT;
- Combined Heat and Power projects in Texas; and
- Preliminary reporting of NOx emissions savings in the 2009 Integrated Savings report to the TCEQ.

3 ANALYSIS ON POWER PRODUCTION FROM WIND FARMS USING 2008 DATA

3.1 Introduction

Texas can now take its place as the largest producer of wind energy in the United States. As of June 2010[2], the capacity of installed wind turbines totals was 9652 MW with another 150 MW under construction. The capacity announced for new projects is 9340 MW by 2013. Figure 3-1 shows the total installed wind power capacity in Texas and power generation in the ERCOT region from 2001 to December 2009. Figure 3-2 shows the location of the wind farms completed, under construction and announced based on the information from the PUCT.

Following the analysis, a summary of total predicted wind power production in the base year (1999) for all wind farms in the ERCOT region is presented. Then a comparison between the estimated wind power in 1999 and the 1999 Ozone Season Period from the 2008 and 2009 reports and the results from this year's modeling are also included in this section to show the performance the modeling procedure.

An uncertainty analysis was also performed on all the daily regression models and included in this report to show the accuracy of applying the OSP and Non-OSP linear regression models to predict the wind power generation that the wind farms would have had in the base year of 1999. The detailed analysis for each wind farm is provided in the Appendix to this report. The original data used in the analysis is included in the accompanying CD-ROM with this report.

[2] Wind project information obtained from the Public Utility Commission of Texas (www.puc.state.tx.us) as of 6/29/2010 and the Electric Reliability Council of Texas (ERCOT) as of December 2009.

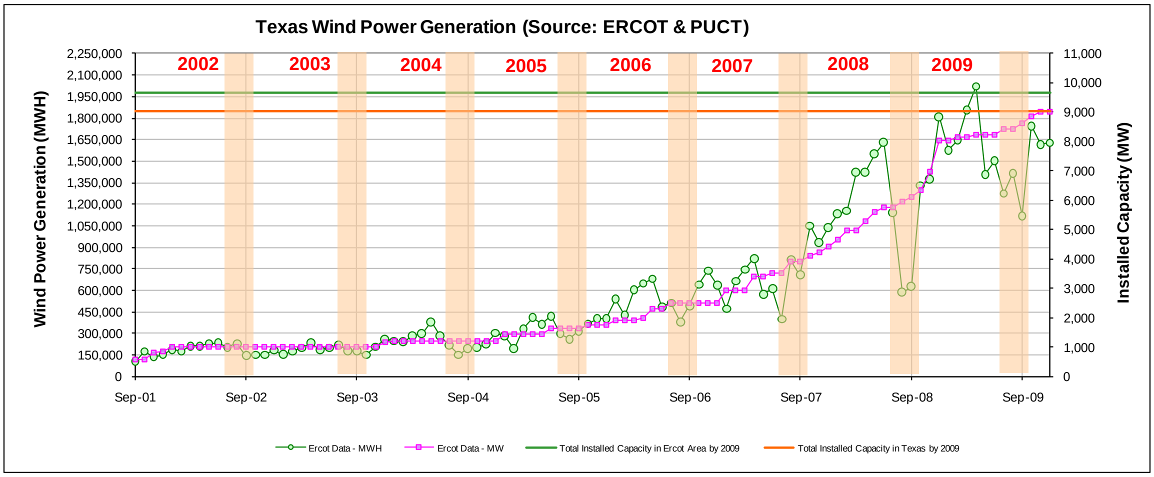
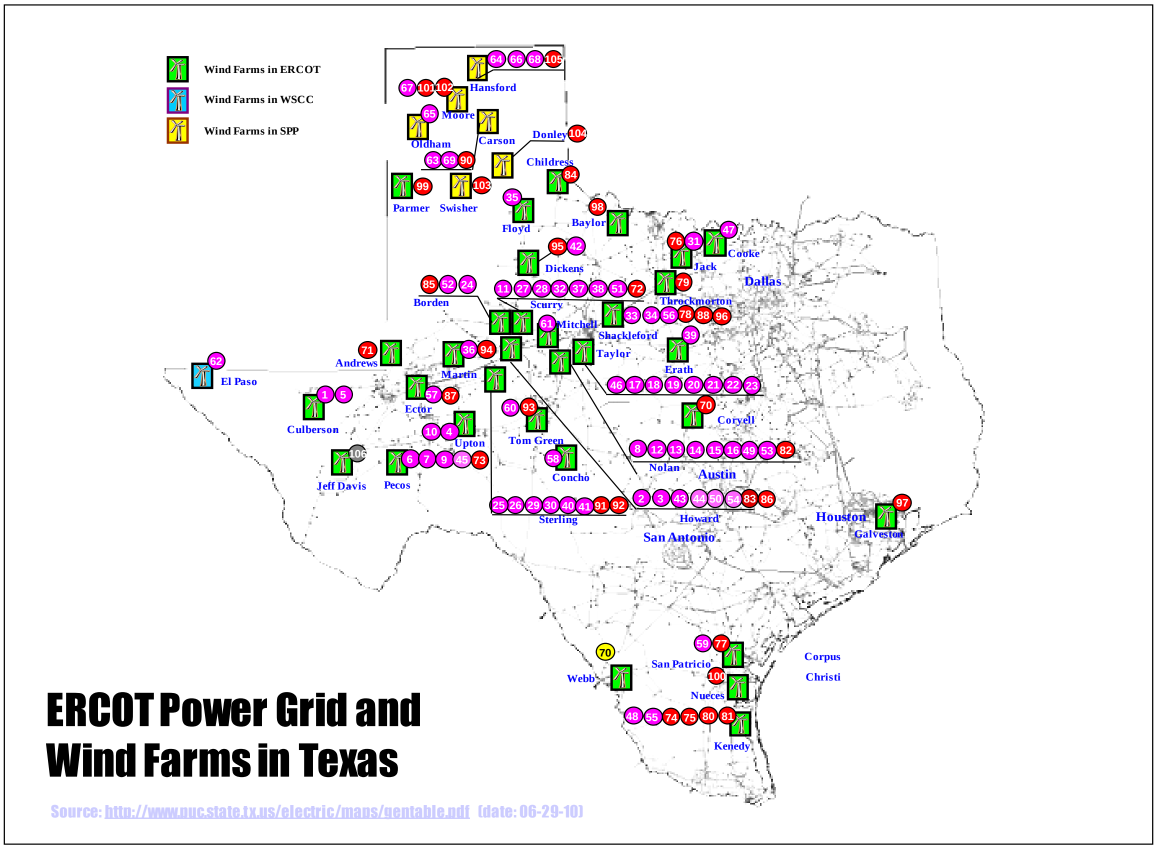


Figure 3-1: Installed Wind Power Capacity and Power Generation in the ERCOT region from 2001 to December 2009



WIND PROJECTS COMPLETED:

ERCOT Region – 8,975 MW

1. Culberson, Texas Wind Power Project, 35MW, Oct-95
2. Howard, Big Spring Wind Power, 34MW, Feb-99
3. Howard, Big Spring Wind Power, 6.6MW, Jun-99
4. Upton, Southwest Mesa Wind Project, 75MW, Jun-99
5. Culberson, Delaware Mountain Wind Farm, 30MW, Jun-99
6. Pecos, Indian Mesa, 82.5MW, Jun-01
7. Pecos, Woodward Mountain Ranch, 160MW, Jul-01
8. Nolan, Trent Mesa, 150MW, Nov-01
9. Pecos, Desert Sky (Indian Mesa II), 160MW, Dec-01
10. Upton, King Mountain Wind Ranch, 278MW, Dec-01
11. Scurry, Brazos Wind Ranch, 160MW, Dec-03
12. Nolan, Sweetwater Wind 1, 37.5MW, Dec-03
13. Nolan, Sweetwater Wind 2, 91.5MW, Feb-05
14. Nolan, Sweetwater Wind 3 (Cottonwood Creek), 135MW, Dec-05
15. Nolan, Sweetwater Wind 4 (Cottonwood Creek), 241MW, May-07
16. Nolan, Sweetwater Wind 5, 80MW, Dec-07
17. Taylor, Callahan Divide Wind Energy Center, 114MW, Feb-05
18. Taylor, Buffalo Gap 1, 120MW, Sep-05
19. Taylor, Buffalo Gap 2 (Cirello 1), 233MW, Aug-07
20. Taylor, Buffalo Gap 3, 170MW, Apr-08
21. Taylor, Horse Hollow Phase 1, 213MW, Oct-05
22. Taylor, Horse Hollow Phase 2, 223.5MW, May-06
23. Taylor, Horse Hollow Phase 3, 299MW, Sep-06
24. Borden, Red Canyon 1, 84MW, May-06
25. Sterling, Forest Creek Wind Farm, 124.2MW, Dec-06
26. Sterling, Sand Bluff Wind Farm, 90MW, Dec-06
27. Scurry, Camp Springs Wind Energy Center, 130MW, Jul-07
28. Scurry, Camp Springs Energy expansion, 120MW, Jun-08
29. Sterling, Capricorn Ridge Wind, 364MW, Sep-07
30. Sterling, Capricorn Ridge Wind exp., 298 MW, May-08
31. Jack, Barton Chapel Wind 1, 120MW, Dec-07
32. Scurry, Snyder Wind Project, 63MW, Dec-07
33. Shackleford, Lone Star - Mesquite Wind, 200MW, Dec-07
34. Shackleford, Lone Star - Post Oak Wind, 200MW, May-08
35. Floyd, Whirlwind, 60MW, Dec-07
36. Martin, Stanton Wind Energy, 120MW, Jan-08
37. Scurry, Champion Wind Farm, 126MW, Jan-08
38. Scurry, Roscoe Wind Farm 1, 209MW, Jan-08
39. Erath, Silver Star Phase I, 60MW, Mar-08
40. Sterling, Goat Wind, 80MW, Apr-08
41. Sterling, Goat Wind Phase 2, 70MW, Apr-09
42. Dickens, McAdoo Wind Energy, 150MW, May-08
43. Howard, Panther Creek, 143MW, Jul-08
44. Howard, Ocotillo Wind Power 1, 59MW, Aug-08
45. Pecos, Sherbino Mesa Wind farm, 150MW, Spe-08
46. Taylor, South Trent Wind Farm, 101.2 MW, Oct-08
47. Cooke, Wolf Ridge Wind farm, 113 MW, Oct-08
48. Kenedy, Gulf Wind 1, 283MW, Nov-08
49. Nolan, Inadale, 197MW, Nov-08
50. Howard, Panther Creek 2, 115MW, Nov-08
51. Scurry, Pyron, 249MW, Nov-08
52. Borden, Bull Creek Wind Plant, 180 MW, Nov-08
53. Nolan, Turkey Track Energy Center, 169.5 MW, Nov-08
54. Howard, Elbow Creek Wind, 117.3MW, Nov-08
55. Kenedy, Penascal Wind Farm, 202MW, Nov-08
56. Shackleford, Hackberry Wind Farm, 165MW, Nov-08
57. Ector, Notrees Wind power, 153MW, Jan-09
58. Concho, Panther Creek 3, 200MW, Aug-09
59. San Patricio, Papalote Creek Wind Farm, 180MW, Sep-09
60. Tom Green, Langford Wind Power, 150MW, Oct-09
61. Mitchell, Loraine Windpark, 251MW, Oct-09

WSCC Region – 1 MW

62. El Paso, Hueco Mountain Wind Ranch, 1.3MW, Apr-01

SPP Region – 676 MW

63. Carson, Llano Estacado Wind Ranch, 79MW, Jan-02
64. Hansford, 3MW, Dec-03
65. Oldham, Wildorado Wind Ranch, 161MW, Apr-07
66. Hansford, Noble Great Plains Windpark, 114MW, Feb-09
67. Moore, Sunray Wind I, II, III, 49.5MW, Aug-09
68. Hansford, JD Wind 1-7, 9-11, Wege, 189.8MW, Dec-09
69. Carson, Majestic Wind Power, 79.5MW, Dec-09

WIND PROJECTS UNDER CONSTRUCTION:

ERCOT Region – 150 MW

70. Webb, Cedro Hill Wind, 150MW, May-10

WIND PROJECTS ANNOUNCED:

ERCOT Region – 9134 MW

70. Coryell, Gatesville Wind Farm, 200MW, Dec-09
71. Andrews, M-Bar Wind, 194MW, Dec-09
72. Scurry, Scurry County Wind III, 350MW, Mar-10
73. Pecos, Sherbino Mesa Wind F arm 2, 150MW, Jul-10
74. Kenedy, Gulf Wind 3, 400MW, Sep-10
75. Kenedy, Gulf Wind 2, 400MW, Oct-10
76. Jack, Senate Wind Project, 150MW, Nov-10
77. San Patricio, Papalote Creek Phase II, 198MW, Dec-10
78. Shackleford, Cedar Elm, 136MW, Dec-10
79. Throckmorton, Throckmortom Wind Farm, 400MW, Dec-10
80. Kenedy, Penascal Wind Farm 2, 202MW, Dec-10
81. Kenedy, Penascal Wind Farm 3, 202MW, Dec-11
82. Nolan, Buffalo Gap 4 and 5, 465MW, Mar-11
83. Howard, Gunsight Mountain, 120MW, Aug-11
84. Childress, Childress County Wind One, 100.8MW, Oct-11
85. Borden, Stephens Wind Farm, 141MW, Nov-11
86. Howard, Wild Horse Mountain, 120MW, Dec-11
87. Ector, Pistol Hill Wind Energy, 300MW, Dec-11
88. Shackleford, Cottonwood Wind, 100MW, Dec-11
89. 600MW, 2011
90. Carson, B&B Panhandle Wind, 1001MW, Jun-12
91. Sterling, Sterling Energy Center, 200MW, Jun-12
92. Sterling, Sterling Energy Center, 300MW, Jun-12
93. Tom Green, Fort Concho Wind Farm, 400MW, Jul-12
94. Martin, Lenorah Wind Farm, 251MW, Sep-12
95. Dickens, McAdoo Energy Center II, 500MW, Dec-12
96. Shackleford, Mesquite Wind 4, 136MW, Jun-13
97. Galveston, Galveston Offshore Wind, 300MW
98. Baylor, Community Wind Energy, 80MW
99. Parmer, Mariah Project, 1000MW
100. Nueces, Harbor Sunrise Wind Project, 37MW

SPP Region – 206MW

101. Moore, Blue Creek, 30MW
102. Moore, Channing Flats, 20MW
103. Swisher, Swisher, 20MW
104. Donley, Hedley Point, 10MW
105. Hansford, Noble Great Plains II, 126MW

WIND PROJECTS RETIRED:

ERCOT Region – 7MW

106. Jeff Davis, Ft. Davis Wind Farm, 7MW, 1996

Figure 3-2: Completed and Announced Wind Projects in Texas by June 2010

3.2 Summary of Wind Power Production for All Wind Farms in the Texas ERCOT Region

Table 3-1shows the summary of the 2008 measured power production for the wind farms that were operating in 2008 in the Texas ERCOT region and the estimated 1999 power production using daily regression models (Appendix B).

Table 3-2shows the monthly average wind speed across four weather stations used in the modeling. As shown in Figure 3-3 and Figure 3-4, the estimated power production in 1999 (14,927,630 MWh/yr) increased about 2% when compared to what was measured in 2008 (14,621,494 MWh/yr). For the Ozone Season Period, the estimated average daily power production in 1999 is 29,144 MWh/day, a 16% increase from that measured in 2008 (24,536 MWh/day). This is because for all the four NOAA weather stations involved in the modeling, 1999 is windier than 2008.

Figure 3-5 presents the comparison of the 2008 measured annual power production against the 1999 estimated annual power production for each wind farm. Figure 3-6 shows the difference between the 2008 measured average daily power production and the 1999 estimated average daily power production during the Ozone Season Period for each wind farm.

From this analysis it can be concluded that the use of weather normalization procedure for predicting 1999 base year production based on 2008 measured power production is more accurate than simply using the measured 2008 power production as the base year power production. Therefore, it is recommended to the TCEQ that the current discount factor be reduced to take the more accurate modeling into account.

Table 3-1: Summary of Power Production for All Wind Farms

Wind Unit Name	County	NOAA Weather Station	Capacity (MW)	2008 Measured (MWh/yr) (ERCOT Original Data)	1999 Estimated Using Daily Model (MWh/yr)	2008 OSP Measured (MWh/day)	1999 OSP Estimated (MWh/day)
BRAZ_WND_WND1	SCURRY	ABI	99.0	287,932	286,275	466	558
BRAZ_WND_WND2	SCURRY	ABI	61.0	219,789	187,016	293	353
BUFF_GAP_UNIT1	TAYLOR	ABI	120.0	347,302	347,148	435	534
BUFF_GAP_UNIT2	TAYLOR	ABI	233.0	592,463	657,194	811	1,049
BUFF_GAP_UNIT3	TAYLOR	ABI	170	148,946	163,986	542	662
CALLAHAN_WND1	TAYLOR	ABI	114.0	409,538	404,330	633	758
CAPRIDGE_CR4	STERLING	ABI	112.5	195,227	197,349	513	596
CAPRIDGE_CR1	STERLING	ABI	214.5	628,522	619,708	1,064	1,235
CAPRIDGE_CR2	STERLING	ABI	149.5	361,820	361,116	564	653
CAPRIDGE_CR3	STERLING	ABI	186	372,514	388,570	783	909
CSEC_CSECG1	SCURRY	LBB	130.0	446,963	453,467	641	739
CSEC_CSECG2	SCURRY	LBB	120.0	351,450	357,589	607	699
DELAWARE_WIND_NWP*	CULBERSON	GDP	29.0	55089.7	53626.3	92	84
ENAS_ENA1	SCURRY	LBB	63.0	169,833	172,403	265	303
FLTCK_SSI	ERATH	ABI	60.0	55,560	70,884	123	205
GOAT_GOATWIND	STERLING	ABI	150.0	137,919	157,421	333	397
H_HOLLOW_WND1	TAYLOR	ABI	213.0	665,515	681,991	959	1,142
HHOLLOW2_WIND1	TAYLOR	ABI	184.0	520,161	539,444	653	849
HHOLLOW3_WND_1	TAYLOR	ABI	224.0	673,657	790,626	943	1,130
HHOLLOW4_WND_1	TAYLOR	ABI	115.0	362,436	356,830	492	578
INDNENR_INDNENR	PECOS	FST	80.0	246,535	257,173	483	598
INDNENR_INDNENR_2	PECOS	FST	80.0	225,394	236,744	426	526
INDNNWP_INDNNWP*	PECOS	FST	83.0	242318.1	254945.1	468	573
KING_NE_KINGNE	UPTON	MAF	79.3	193,676	206,953	303	353
KING_NW_KINGNW	UPTON	MAF	79.3	222,495	235,699	380	435
KING_SE_KINGSE	UPTON	MAF	40.3	95,573	102,313	156	182
KING_SW_KINGSW	UPTON	MAF	79.3	135,752	141,620	321	369
KUNITZ_WIND_LGE*	CULBERSON	GDP	35.0	38037.2	37111.4	50	44
LNCRK2_G871	SHACKLEFORD	ABI	100	209,612	209,916	521	619
LNCRK2_G872	SHACKLEFORD	ABI	100	209,189	209,623	504	598
LNCRK_G83	SHACKLEFORD	ABI	200.0	544,024	548,771	946	1,132
MCDLD_FCW1	STERLING	SJT	124.0	428,366	420,543	637	735
MCDLD_SBW1	STERLING	SJT	90.0	275,838	224,617	436	517
RDCANYON_RDCNY1	BORDEN	ABI	84.0	330,353	325,652	538	632
SGMTN_SIGNALMT*	HOWARD	MAF	41.0	96363.9	101964.0	142	167
SWEC_G1	MARTIN	MAF	124	289,053	303,958	622	728
SW_MESA_SW_MESA*	UPTON	MAF	75.0	212286.5	226536.5	396	466
SWEETWN2_WND2	NOLAN	ABI	100.0	327,456	323,104	490	579
SWEETWN2_WND24	NOLAN	ABI	18.0	54,202	53,532	74	87
SWEETWN3_WND3	NOLAN	ABI	135.0	418,947	412,225	617	724
SWEETWN4_WND4A	NOLAN	ABI	135.0	328,020	327,428	561	600
SWEETWN4_WND4B	NOLAN	ABI	106.0	304,019	301,544	455	535
SWEETWN4_WND5	NOLAN	ABI	81	242,826	238,098	337	399
SWEETWND_WND1	NOLAN	ABI	37.5	126,430	126,648	178	216
TKWSW1_ROSCOE	SCURRY	LBB	220	420,188	422,591	820	934
TKWSW_CHAMPION	SCURRY	LBB	127	281,215	286,696	522	580
TRENT_TRENT	NOLAN	ABI	150.0	488,800	480,340	754	902
WEC_WECG1	FLOYD	LBB	60	223,082	227,304	403	467
WOODWRD1_WOODWRD1*	PECOS	FST	80.0	210722.7	225146.6	398	515
WOODWRD2_WOODWRD2*	PECOS	FST	80.0	198083.1	211863.3	386	499
TOTAL			5571.2	14,621,494	14,927,630	24,536	29,144

Wind farms in Italic were built before 9/2001.

Table 3-2: Summary of 1999 and 2008 Monthly Average Wind Speed for Four NOAA Weather Stations

Month	Wind Speed ABI (mph)		Wind Speed MAF (mph)		Wind Speed FST (mph)		Wind Speed GDP (mph)	
	1999	2008	1999	2008	1999	2008	1999	2008
Jan	11.8	12.1	10.9	9.3	12.0	10.3	21.2	20.9
Feb	12.2	12.3	11.2	10.8	11.4	11.0	22.4	25.1
Mar	12.1	13.4	11.8	12.4	11.8	12.1	21.5	20.8
Apr	13.6	13.9	13.5	12.0	13.1	11.9	20.9	22.6
May	12.4	12.8	12.8	12.8	12.6	12.7	19.9	21.4
Jun	12.7	13.7	12.8	13.9	12.0	13.5	16.3	19.2
Jul	11.7	10.6	12.3	11.2	12.3	11.3	14.8	15.1
Aug	8.4	7.4	8.0	8.1	8.8	8.6	13.5	14.0
Sep	10.4	8.0	10.1	6.7	9.9	8.2	16.8	13.9
Oct	10	10.5	9.1	9.1	10.4	10.5	14.2	15.0
Nov	9.7	10.2	8.3	8.3	9.5	9.2	18.2	17.8
Dec	10.7	12.2	10.0	10.0	10.6	10.4	20.6	24.3
Annual Average	11.3	11.4	10.9	10.4	11.2	10.8	18.3	19.2
OSP Average	9.7	8.7	9.5	8.7	10.0	8.9	13.9	14.3

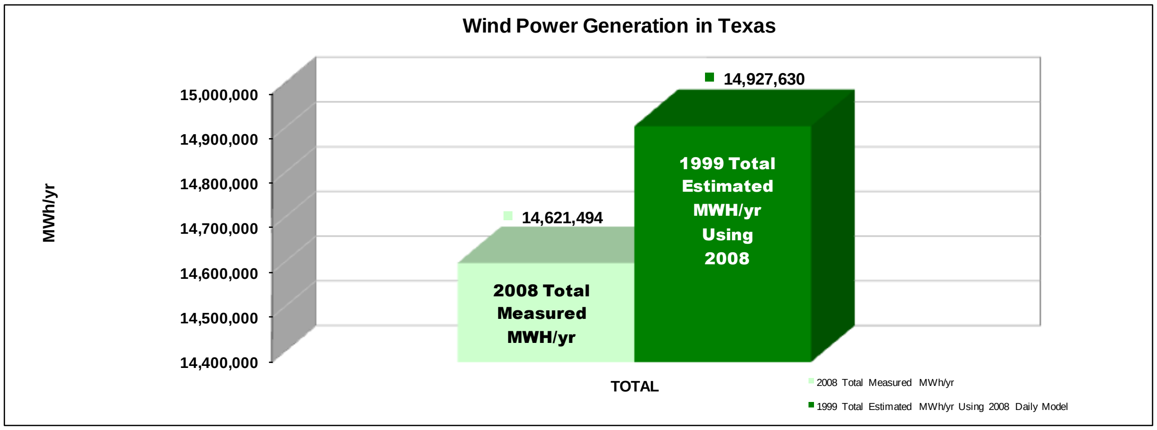


Figure 3-3: Comparison of Total 2008 Measured and 1999 Estimated Power Production

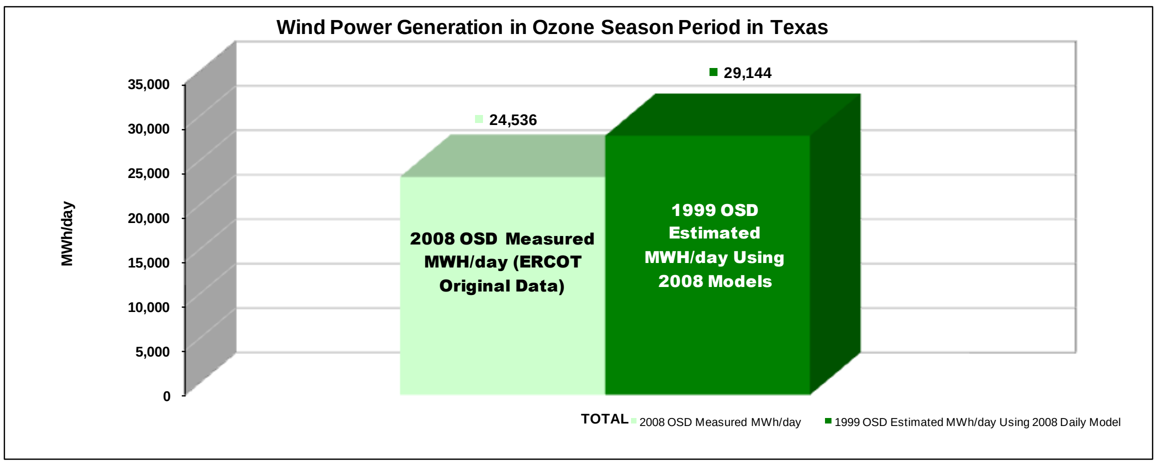


Figure 3-4: Comparison of Total 2008 OSD Measured and 1999 OSD Estimated Power Production

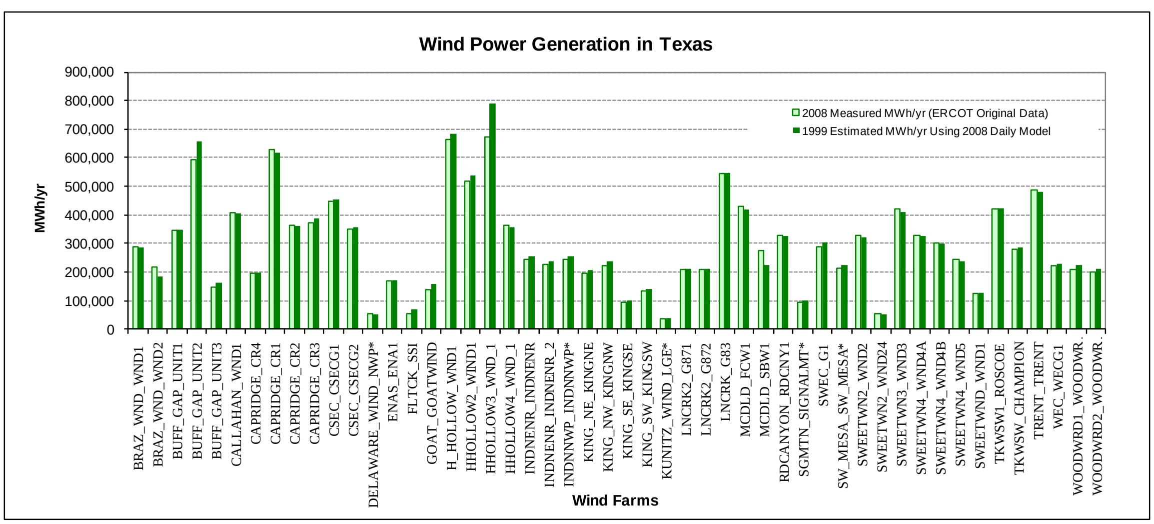


Figure 3-5: Comparison of 2008 Measured and 1999 Estimated Power Production for Each Wind Farm

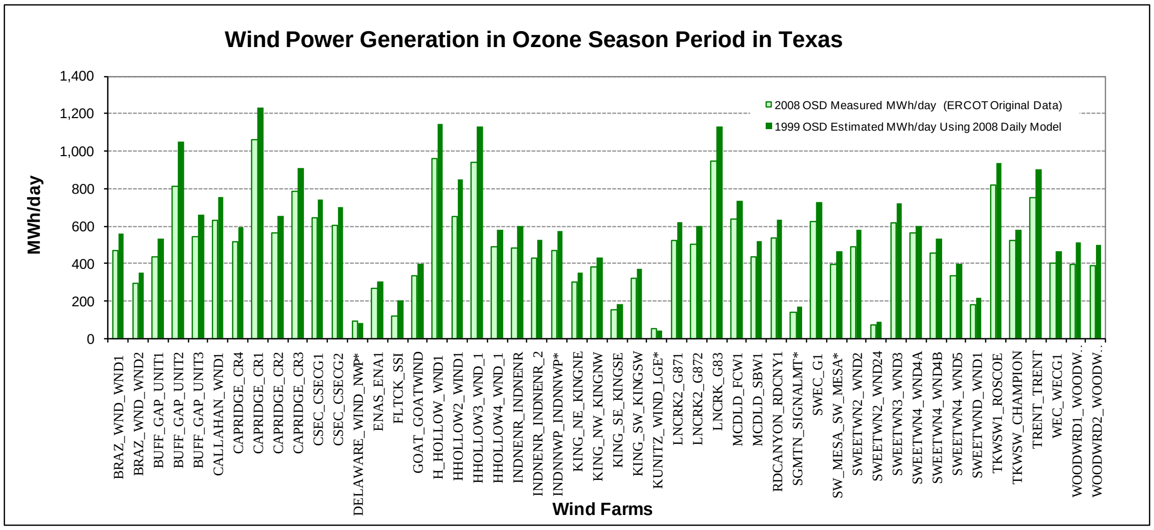


Figure 3-6: Comparison of 2008 OSD Measured and 1999 OSD Estimated Power Production for Each Wind Farm

3.3 Comparison of 1999 Estimated Wind Power in 2008 & 2009 Report and This Report

Compared to what was reported in the 2009 annual report, an increase of 17% on predicted annual wind power in 1999 was observed, from 8,511,100 MWh/yr to 10,226,399 MWh/yr. The average daily wind power in the 1999 OSD period showed a higher increase of 20%, from 20,094 MWh/day to 25,151 MWh/day. The total wind power capacity included in this year's analysis increased from 7,838 MW to 9,020 MWh (a 52% increase).

Figure 3-7 (a) shows the annual comparison of measured wind power of 2005, 2006, 2007 and 2008 for all the wind farms. Table 3-3 shows the average monthly wind speed for the main four weather stations used in the analysis. In general, most of the wind farms operated at the similar output level for these three years. The total annual wind power production in 2008 for most wind farms was a little higher than in 2005, 2006 and 2007.

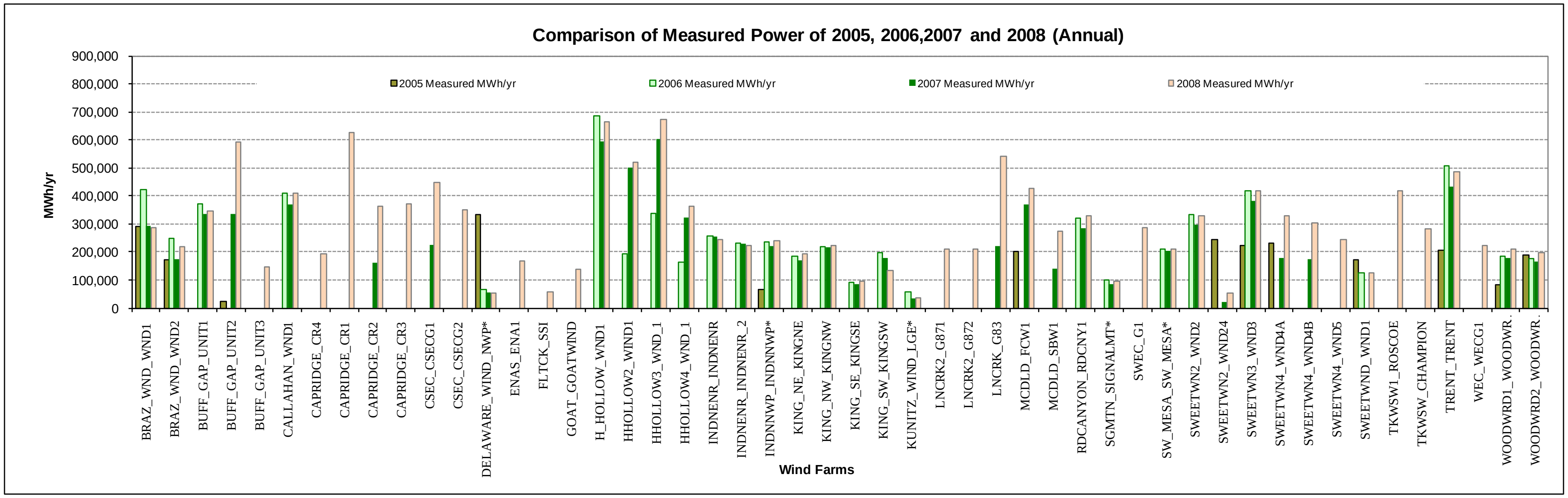
Figure 3-7 (b) shows the comparison of measured power of 2005, 2006, 2007 and 2008for the Ozone Season Period. It is noted that for most of the wind farms, the measured average daily wind power in 2006 OSD is lower than that of 2005, 2007 and 2008, which is different than the annual trend. As shown inTable 3-5, this may 0be due to the opposite wind condition in the OSD period.

Figure 3-7 (a) shows the annual comparison of the estimated power in 1999 using the annual model of 2005 and the OSP and Non-OSP models of 2007 and 2008.

Figure 3-9 and Figure 3-10 show that, in general, the variation in the 1999 predicted wind power caused by using measured data from different years is much smaller than the difference between the 2007 and 2008 measured wind power for most of the wind farms with steady operation. This observation confirms the robust performance and importance of the weather normalization procedure. Due to the absence of detailed information on curtailment, maintenance, or other factors, the explanation on the difference in trend among individual wind farms is not included in this work.

Table 3-3: Comparison of Wind Speed of 2005, 2006, 2007 and 2008

Month	Wind Speed ABI (mph)				Wind Speed MAF (mph)				Wind Speed FST (mph)				Wind Speed GDP (mph)			
	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
Jan	10.3	11.9	9.5	12.1	9.7	10.6	9.6	9.3	10.2	11.1	9.0	10.3	19.1	22.4	22.7	20.9
Feb	8.9	11.1	12.0	12.3	8.9	9.9	11.2	10.8	9.2	10.2	11.2	11.0	21.5	21.2	23.8	25.1
Mar	11.5	12.6	11.8	13.4	11.1	11.9	10.3	12.4	11.1	11.7	11.8	12.1	22.3	23.7	16.8	20.8
Apr	13	12.3	12.9	13.9	12.1	12.2	12.3	12.0	12.5	12.1	13.0	11.9	19.9	22.2	22.1	22.6
May	11	12.3	9.3	12.8	10.8	10.8	9.7	12.8	11.7	12.3	10.0	12.7	17.3	17.1	18.6	21.4
Jun	11.9	9.8	9.5	13.7	12.1	12.1	10.0	13.9	12.4	10.9	10.2	13.5	15.7	14.8	17.1	19.2
Jul	9.9	10.1	7.0	10.6	10.4	10.4	8.0	11.2	10.6	10.6	9.3	11.3	16.0	14.1	15.1	15.1
Aug	8.3	9.2	9.1	7.4	9.2	9.2	10.0	8.1	8.5	8.9	10.5	8.6	12.9	13.6	14.2	14.0
Sep	9.3	9.5	9.0	8.0	9.7	9.7	8.9	6.7	9.2	9.5	9.8	8.2	14.5	15.5	13.8	13.9
Oct	9.3	10.7	11.0	10.5	9.3	9.3	10.2	9.1	9.7	10.5	10.3	10.5	16.8	17.1	17.6	15.0
Nov	10.3	10.9	10.4	10.2	9.4	9.4	8.9	8.3	10.3	11.0	8.4	9.2	19.8	19.7	19.2	17.8
Dec	10	10.8	10.6	12.2	9.5	9.5	8.8	10.0	8.6	10.4	9.7	10.4	19.5	20.8	22.0	24.3
Annual Average	10.3	10.9	10.2	11.4	10.2	10.2	9.8	10.4	10.3	10.8	10.3	10.8	18.0	18.5	18.6	19.2
OSP Average	9.0	9.2	8.2	8.7	9.7	8.9	9.0	8.7	9.3	9.2	10.0	8.9	14.5	14.2	15.8	14.3



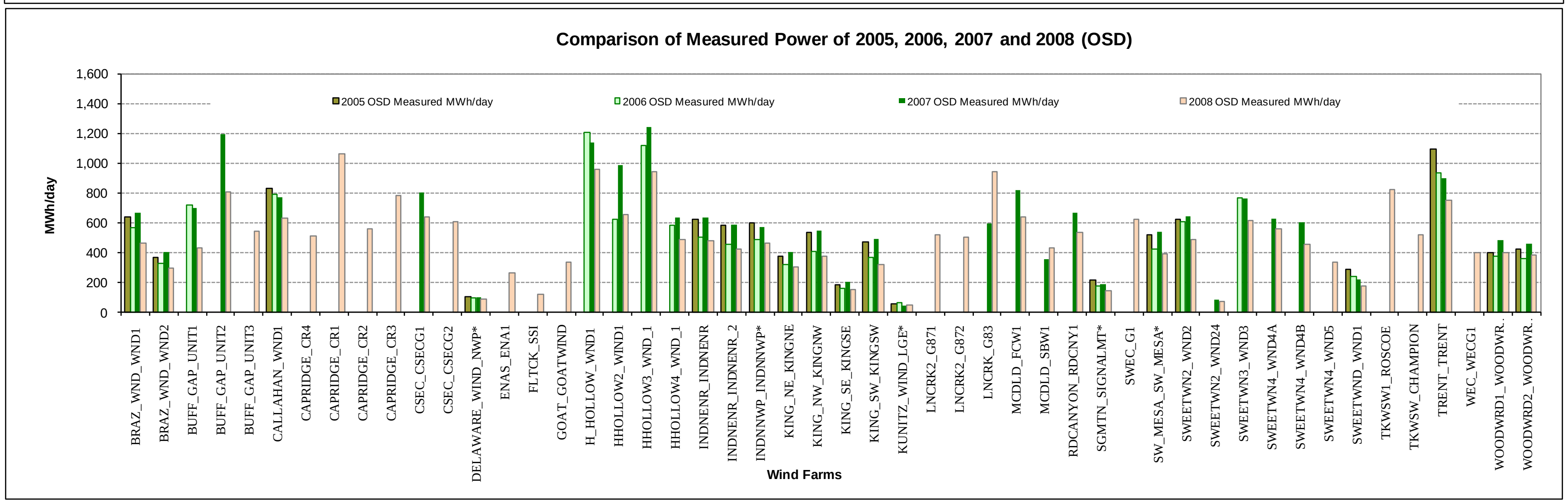
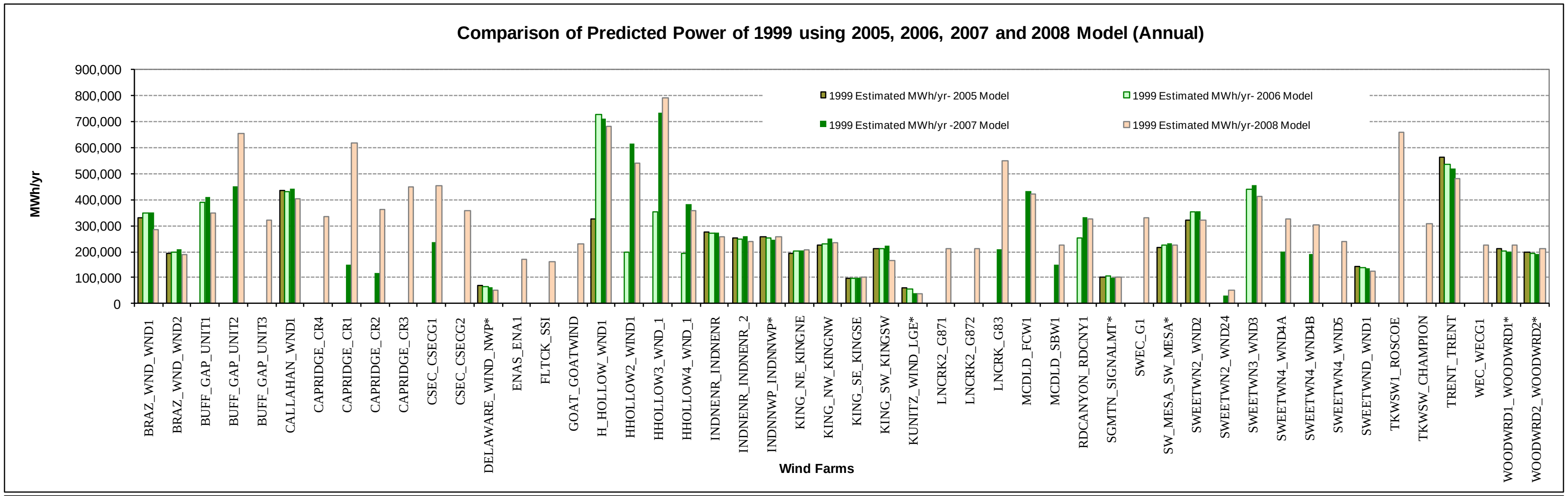


Figure 3-7: Comparison of Measured Wind Power of 2005, 2006, 2007 and 2008 (Annual and OSD)



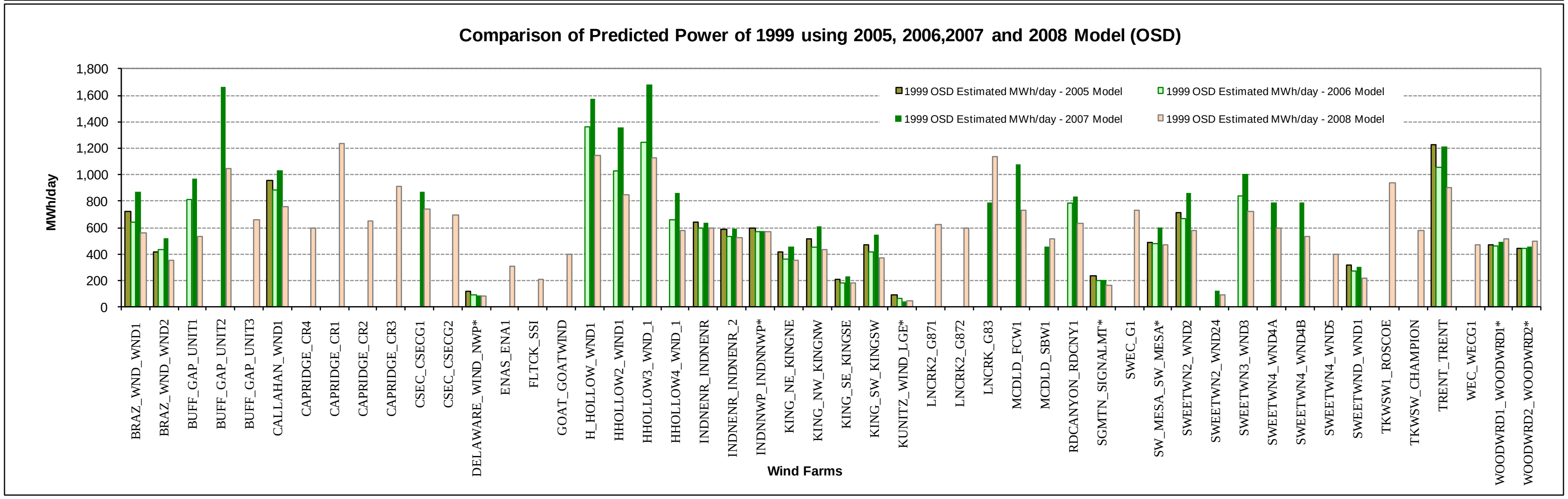


Figure 3-8: Comparison of Estimated Power of 1999 using the 2005, 2006, 2007 and 2008 Model (Annual and OSD)

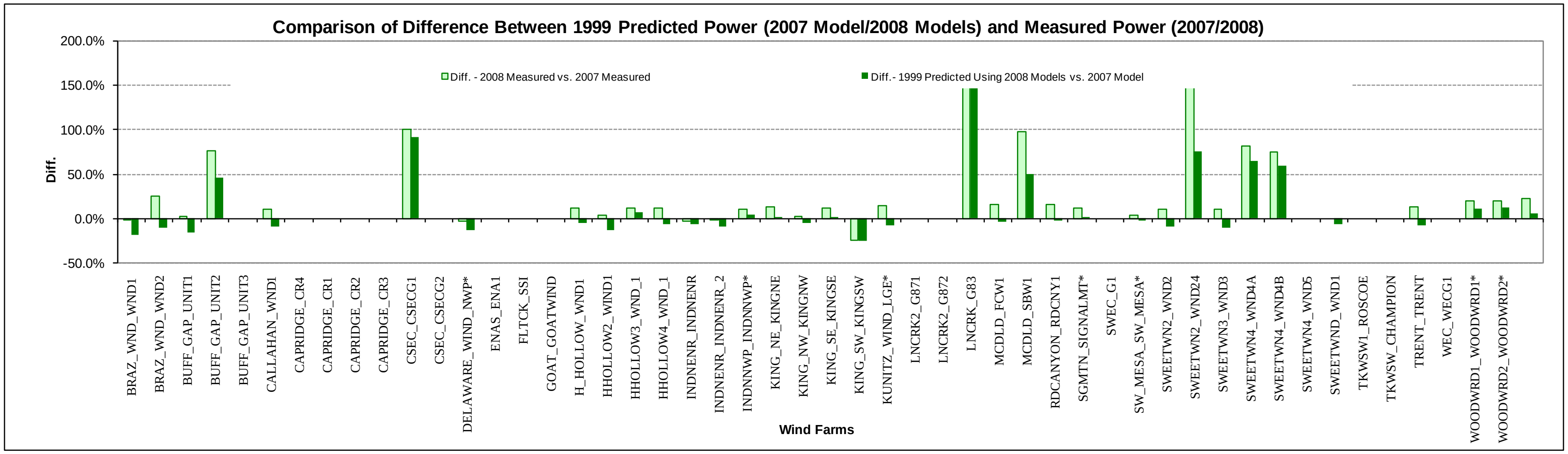


Figure 3-9: Comparison of Difference between 1999 Predicted Power and 2007/2008 Measured Power

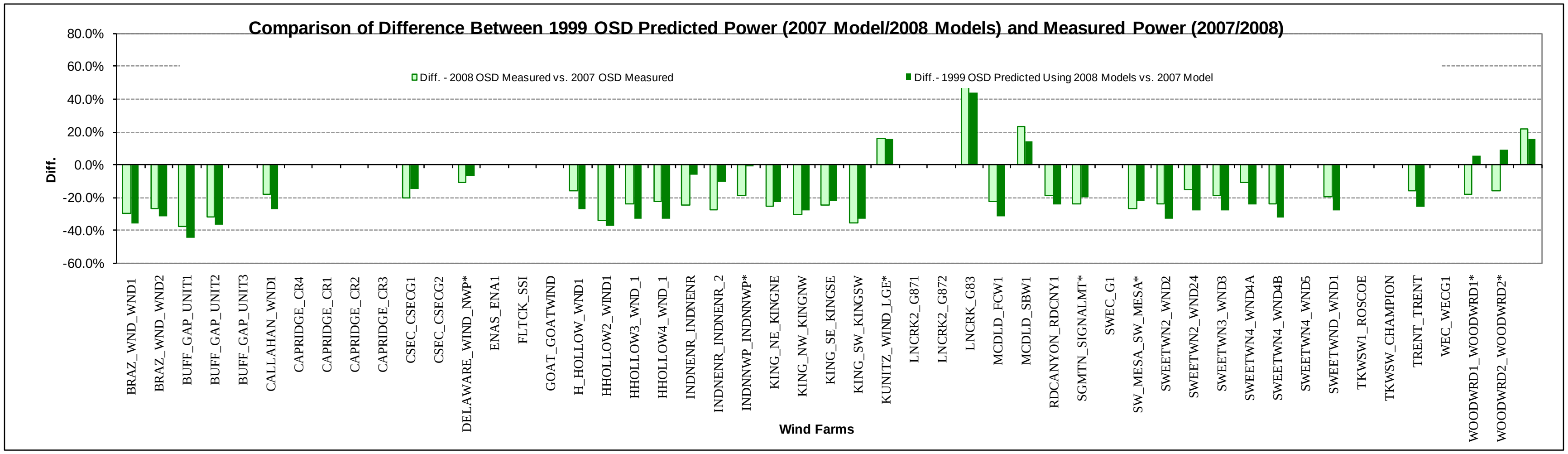


Figure 3-10: Comparison of Difference between 1999 OSD Predicted Power and 2007/2008 OSD Measured Power

3.4 Uncertainty Analysis on the 2008 Daily Regression Models

One of the advantages of using regression models is that they allow for an uncertainty analysis to be calculated, which can be used to assess the accuracy of the model. This section of the report presents an updated uncertainty analysis for the daily regressions that were applied to the 2008 data.

Assuming that the daily energy production of wind farm data can be related linearly with the daily average wind speed (see Figure 3-11) and expressed as

$$\hat{E}_i = c_o + c_1 V_i \qquad (1)$$

Where V is the daily average wind speed, $\hat{E}$ is the daily total energy production, and c_o and c_1 are the resultant coefficients of a linear regression. The subscript i presents any day over the modeling period.

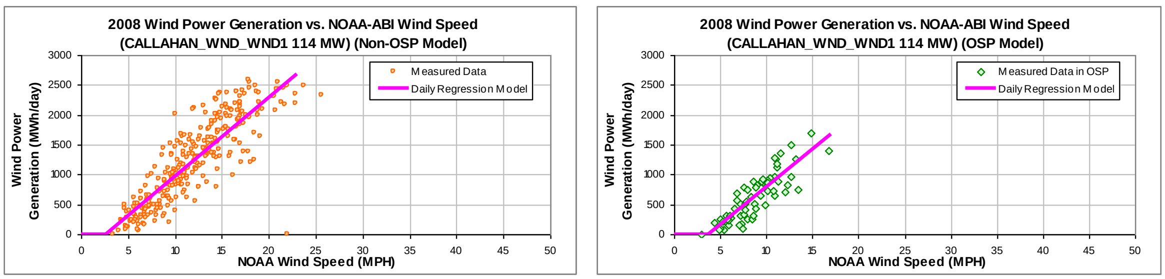


Figure 3-11: Linear Model Presentation of the Daily Wind Power Generation on the Year 2008 for Callahan Wind Farm

The primary purpose of modeling in this analysis is to back-cast the wind power production, or predict the power production in another year that would have occurred if the turbines had been installed and operating. This allows for the evaluation of the NOx reductions during the base-year weather conditions. Unfortunately, any prediction intrinsically contains an uncertainty, which is related to the prediction variance. Thus, the prediction uncertainty, $\sigma^2\left(\hat{E}_{pred,j}\right)$, assuming no autocorrelation effects in the data used to generate the linear model, can be presented for a particular observation, j, during any time a particular condition is presented as follows:

$$\sigma^2\left(\hat{E}_{pred,j}\right) = MSE\left(\hat{E}_i\right) \cdot \left[1 + \frac{1}{n} + \frac{\left(V_j - \overline{V}_n\right)^2}{\sum_{i=1}^{n}\left(V_i - \overline{V}_n\right)^2}\right] \qquad (2)$$

The mean square error, $MSE\left(\hat{E}_i\right)$, during the period of the development of the linear model can be computed by:

$$MSE\left(\hat{E}_i\right) = \left[\frac{1}{n-(k+1)}\right] \sum_{i=1}^{n}\left(E_i - \hat{E}_i\right)^2 \qquad (3)$$

Where n is the number of days in the period used for the developed model, k is the number of regressor variables in the linear model, and $\overline{V}_n$ is the mean value of the velocity on the modeling period.

The last term in the brackets of the equation 2 accounts for the increase in the variance of the energy prediction for any particular observation, *j*, which is different from the centroid of the modeling data. On the other hand, the second term accounts for the variance in predicting the mean energy predicted for the observation, *j*.

The total uncertainty for a period of interest, of *m* days, is then the sum of all the wind energy predicted $\hat{E}_{pred,j}$ in each individual observation.

Assuming that

$$\sum_{j=1}^{m} \sigma^2\left(\hat{E}_{pred,j}\right) = \sigma^2\left(\sum_{j=1}^{m}\left(\hat{E}_{pred,j}\right)\right) = \sigma^2\left(\hat{E}_{pred,total}\right) \tag{4}$$

And the total prediction variance or uncertainty is obtained through

$$\sigma^2\left(\hat{E}_{pred,total}\right) = MSE\left(\hat{E}_i\right) \cdot m \cdot \left[1 + \frac{1}{n} + \frac{\sum_{j=1}^{m}\left(V_j - \overline{V}_n\right)^2}{m\sum_{i=1}^{n}\left(V_i - \overline{V}_n\right)^2}\right] \tag{5}$$

Thus, it is observable that the last equation is affected by the number of days that the wind energy will be predicted, the number of days used for the modeling development and the uncertainty due to the distances between the data predicted and the centroid of the modeling data. Therefore, increasing *n* and *m* yields an effective relative decrease in the uncertainty—which is expected.

Table 3-4 presents all the statistics parameters for the daily linear models of all the wind farms in the ERCOT region.

Table 3-5shows the uncertainty of applying the linear models to predict the energy generation that they would have had in the year 1999, ranging from 2% to 5%. The results indicate that the daily models are reasonably reliable for predicting the performance of the wind farm in the base year within the same range of wind conditions.

Also, the same table includes the uncertainty related to the predicted wind generated for the same wind farms in the 1999 Ozone Season Period using the OSP model, which consider the period of July 15 though Sep 15 – about 63 days. The uncertainty of using OSP models for predicting wind power in the 1999 OSD varies from 3.8% to 11.8% for all the wind farms.

Table 3-4: Statistical Parameters of the Determined 2008 Daily Power Production Linear Models

Wind Farm	Statistical Parameters of 2008 Non-OSP Daily Models						Statistical Parameters of 2008 OSP Daily Models					
	c_0	c_1	$AdjR^2$	RMSE	CV-RMSE	# Days	c_0	c_1	$AdjR^2$	RMSE	CV-RMSE	# Days
BRAZ_WND_WND1	-3.20	71.82	0.36	422.40	49.2%	300	-338.22	92.29	0.52	242.31	52.0%	63
BRAZ_WND_WND2	-132.17	58.32	0.54	218.01	41.2%	269	-230.97	60.16	0.63	125.60	42.9%	63
BUFF_GAP_UNIT1	-331.94	117.87	0.65	379.09	35.3%	297	-297.96	85.67	0.56	207.12	47.6%	59
BUFF_GAP_UNIT2	-887.50	244.69	0.76	577.65	30.6%	266	-737.89	184.08	0.63	359.60	44.3%	58
BUFFALO_GAP_3	-59.03	84.66	0.33	522.43	62.1%	140	-231.45	92.04	0.56	226.85	41.9%	55
CALLAHAN_WND1	-353.72	132.02	0.73	356.35	28.9%	300	-459.17	125.36	0.73	208.68	33.0%	63
CAPRIDG4_CR4	-437.84	122.22	0.81	266.10	28.2%	172	-209.89	82.99	0.58	195.86	38.2%	62
CAPRIDGE_CR1*	-132.52	165.79	0.55	612.99	35.2%	254	-416.36	170.12	0.50	479.11	45.0%	59
CAPRIDGE_CR2*	-225.93	110.61	0.52	465.55	42.4%	297	-205.28	88.35	0.61	192.91	34.2%	63
CAPRIDGE_CR3	-272.14	135.33	0.47	629.93	47.6%	243	-316.90	126.24	0.60	280.50	35.8%	63
CSEC_CSECG1	-223.33	125.79	0.58	468.12	34.9%	302	-380.38	113.70	0.35	352.94	55.0%	63
CSEC_CSECG2	35.58	80.30	0.32	506.57	49.0%	303	-349.00	106.42	0.37	321.55	52.9%	63
ENAS_ENA1	0.55	40.61	0.35	239.50	47.4%	303	-134.31	44.40	0.33	145.42	54.9%	63
FLTCK_SSI	-164.93	56.87	0.76	141.71	33.9%	106	-127.59	34.25	0.71	58.23	47.5%	35
GOAT_GOATWIND	-376.28	91.27	0.77	222.78	33.6%	172	-211.95	62.69	0.58	150.45	45.2%	58
H_HOLLOW_WND1	-669.85	231.41	0.77	549.53	26.5%	291	-638.48	183.42	0.79	259.43	27.0%	63
HHOLLOW2_WIND1	-678.19	196.75	0.76	487.78	29.6%	283	-641.59	153.54	0.76	214.70	32.9%	60
HHOLLOW3_WND_1	-223.80	224.23	0.56	812.88	38.7%	284	-588.45	176.97	0.50	396.85	42.1%	63
HHOLLOW4_WND_1	-240.65	112.00	0.70	320.94	29.1%	300	-251.90	85.45	0.67	162.77	33.1%	63
INDNENR_INDNENR	-235.78	84.54	0.49	306.71	43.9%	293	-418.43	102.11	0.52	221.77	45.9%	61
INDNENR_INDNENR_2	-242.64	80.51	0.49	298.35	45.4%	298	-355.56	88.56	0.48	210.22	49.3%	61
KING_NE_KINGNE	-229.61	75.08	0.71	205.16	35.7%	302	-204.70	58.87	0.53	124.89	41.2%	62
KING_NW_KINGNW	-148.63	74.84	0.56	281.15	43.0%	302	-174.02	64.28	0.44	163.94	43.1%	62
KING_SE_KINGSE	-117.15	37.30	0.72	98.32	34.8%	302	-105.86	30.40	0.52	65.24	41.8%	62
KING_SW_KINGSW	-55.67	47.37	0.48	215.98	46.8%	249	-166.35	56.57	0.47	135.17	42.1%	62
LNCRK_G83	-581.74	186.05	0.75	471.82	28.9%	291	-672.39	185.86	0.77	276.20	29.2%	63
LNCRK2_G871	-62.88	54.11	0.23	436.07	74.2%	301	-330.20	97.72	0.76	148.96	28.6%	63
LNCRK2_G872	-62.33	54.35	0.23	431.85	73.0%	300	-311.33	93.65	0.75	149.06	29.6%	63
MCDLD_FCW1	-261.58	129.13	0.63	436.51	34.0%	302	-262.32	102.72	0.57	244.08	38.3%	62
MCDLD_SBW1	127.31	43.76	0.35	213.49	37.8%	198	*-207.34*	*74.61*	*0.51*	*191.31*	*43.9%*	*60*
RDCANYON_RDCNY1	-85.80	88.82	0.61	309.00	31.6%	300	*-285.18*	*94.48*	*0.57*	*221.72*	*41.2%*	*63*
SWEC_G1	30.96	81.23	0.36	467.08	50.9%	271	*-450.93*	*124.50*	*0.61*	*224.19*	*36.0%*	*62*
SWEETWN2_WND2	-203.60	99.17	0.67	306.94	31.1%	301	*-352.94*	*96.03*	*0.79*	*137.20*	*28.0%*	*61*
SWEETWN2_WND24	-79.06	20.45	0.81	43.19	26.1%	297	*-67.70*	*16.14*	*0.75*	*25.95*	*35.1%*	*61*
SWEETWN3_WND3	-323.71	132.31	0.77	320.42	25.3%	301	*-387.26*	*114.42*	*0.81*	*152.76*	*24.8%*	*61*
SWEETWN4_WND4A	-216.50	101.15	0.60	360.55	35.3%	289	*-234.23*	*85.88*	*0.78*	*124.35*	*22.2%*	*51*
SWEETWN4_WND4B	-188.65	92.53	0.61	325.22	35.3%	298	*-250.17*	*80.92*	*0.77*	*120.01*	*26.4%*	*63*
SWEETWND_WND1	-128.60	43.26	0.72	118.60	30.6%	299	*-140.22*	*36.73*	*0.64*	*71.60*	*40.3%*	*57*
SWEETWND4_WND5	-165.82	74.94	0.66	238.10	32.4%	301	*-205.33*	*62.22*	*0.73*	*103.94*	*30.9%*	*63*
TKWSW_CHAMPION	259.48	51.02	0.17	491.91	54.9%	277	*-79.88*	*67.02*	*0.22*	*282.28*	*54.0%*	*63*
TKWSW1_ROSCOE	-656.21	211.78	0.61	758.84	40.6%	197	*-367.91*	*132.20*	*0.29*	*470.27*	*57.3%*	*63*
TRENT_TRENT	-451.65	159.51	0.66	503.74	34.5%	302	*-532.51*	*147.72*	*0.68*	*274.50*	*36.4%*	*63*
WEC_WECG1	23.41	50.61	0.45	241.81	37.1%	303	*-255.65*	*73.34*	*0.36*	*223.51*	*55.4%*	*63*
DELAWARE_WIND_NWP	-76.64	12.29	0.73	54.17	31.1%	259	*-115.93*	*14.34*	*0.84*	*32.90*	*35.8%*	*51*
INDNNWP_INDNNWP	-273.23	87.62	0.47	326.36	45.6%	296	*-418.53*	*99.60*	*0.48*	*228.40*	*48.8%*	*60*
KUNITZ_WIND_LGE	-91.95	10.67	0.72	48.89	39.2%	255	*-97.95*	*10.14*	*0.79*	*27.66*	*55.6%*	*50*
SGMTN_SIGNALMT	-1.54	27.17	0.47	119.25	41.5%	300	*-113.08*	*29.53*	*0.45*	*73.40*	*51.9%*	*62*
SW_MESA_SW_MESA	-157.18	72.31	0.59	254.00	41.1%	302	*-317.10*	*82.70*	*0.52*	*179.31*	*45.3%*	*62*
WOODWRD1_WOODWRD1	-476.27	97.66	0.70	228.22	36.5%	297	*-589.71*	*110.96*	*0.69*	*166.00*	*41.7%*	*60*
WOODWRD2_WOODWRD2	-427.65	89.86	0.71	203.95	34.7%	296	*-563.20*	*106.68*	*0.72*	*149.55*	*38.7%*	*60*

Table 3-5: 1999 Uncertainty of the Power Generation Prediction using the Linear Daily Models

Wind Farm	1999 Non Ozone Season Period				1999 Ozone Season Period (OSP)			
	Predicted days	Total Variance	Total Estimated	Relative Uncertainty	Predicted Days	Total Variance	Total Estimated	Relative uncertainty
BRAZ_WND_WND1	302	14,407.81	286,275	5.03%	63	3,785.72	35,142.7	10.77%
BRAZ_WND_WND2	302	7,439.18	187,016	3.98%	63	1,964.54	22,245.6	8.83%
BUFF_GAP_UNIT1	302	12,931.07	347,148	3.72%	63	3,231.17	33,629.0	9.61%
BUFF_GAP_UNIT2	302	19,708.70	657,194	3.00%	63	5,625.69	93,759.8	6.00%
BUFFALO_GAP_3	302	17,849.86	321,031	5.56%	63	3,553.96	48,064.1	7.39%
CALLAHAN_WND1	302	12,154.63	404,330	3.01%	63	3,255.04	47,752.5	6.82%
CAPRIDG4_CR4	302	9,085.25	334,416	2.72%	63	3,063.84	47,175.4	6.49%
CAPRIDGE_CR1	302	20,920.17	619,708	3.38%	63	7,479.84	93,061.1	8.04%
CAPRIDGE_CR2	302	15,871.64	361,116	4.40%	63	3,020.30	53,426.1	5.65%
CAPRIDGE_CR3	302	21,480.96	450,051	4.77%	63	4,408.61	65,632.1	6.72%
CSEC_CSECG1	302	15,958.70	453,467	3.52%	63	5,536.32	63,970.7	8.65%
CSEC_CSECG2	302	17,269.61	357,589	4.83%	63	5,095.16	52,060.7	9.79%
ENAS_ENA1	302	8,164.95	172,403	4.74%	63	2,304.33	25,231.8	9.13%
FLTCK_SSI	302	4,840.16	162,719	2.97%	63	923.85	24,394.0	3.79%
GOAT_GOATWIND	302	7,601.25	231,910	3.28%	63	2,364.64	32,120.8	7.36%
H_HOLLOW_WND1	302	18,745.44	681,991	2.75%	63	4,047.24	71,972.3	5.62%
HHOLLOW2_WIND1	302	16,639.21	539,444	3.08%	63	3,349.87	53,500.2	6.26%
HHOLLOW3_WND_1	302	27,734.67	790,626	3.51%	63	6,210.47	71,177.0	8.73%
HHOLLOW4_WND_1	302	10,946.84	356,830	3.07%	63	2,538.95	36,398.0	6.98%
INDNENR_INDNENR	300	10,430.86	258,590	4.03%	63	3,463.47	37,702.3	9.19%
INDNENR_INDNENR_2	300	10,145.43	238,048	4.26%	63	3,282.36	33,166.4	9.90%
KING_NE_KINGNE	302	6,997.51	206,953	3.38%	63	1,950.30	22,236.4	8.77%
KING_NW_KINGNW	302	9,589.54	235,699	4.07%	63	2,560.25	27,393.0	9.35%
KING_SE_KINGSE	302	3,353.47	102,313	3.28%	63	1,018.88	11,473.4	8.88%
KING_SW_KINGSW	302	7,368.19	166,700	4.42%	63	2,110.21	23,276.9	9.07%
LNCRK_G83	302	16,093.71	548,771	2.93%	63	4,308.79	77,153.8	5.58%
LNCRK2_G871	302	14,873.94	209,916	7.09%	63	2,327.26	29,139.2	7.99%
LNCRK2_G872	302	14,729.93	209,623	7.03%	63	2,328.67	29,320.5	7.94%
MCDLD_FCW1	302	14,888.54	420,543	3.54%	63	3,807.74	62,506.7	6.09%
MCDLD_SBW1	302	7,294.90	224,617	3.25%	63	2,992.98	34,788.1	8.60%
RDCANYON_RDCNY1	302	10,539.78	325,652	3.24%	63	3,458.59	48,922.6	7.07%
SWEC_G1	302	15,933.02	330,028	4.83%	63	3,508.11	50,422.3	6.96%
SWEETWN2_WND2	302	10,469.30	323,104	3.24%	63	2,140.34	47,835.7	4.47%
SWEETWN2_WND24	302	1,473.34	53,863	2.74%	63	404.89	7,526.6	5.38%
SWEETWN3_WND3	302	10,929.25	412,225	2.65%	63	2,383.16	60,537.6	3.94%
SWEETWN4_WND4A	302	12,299.18	327,428	3.76%	63	1,941.63	48,233.3	4.03%
SWEETWN4_WND4B	302	11,093.10	301,544	3.68%	63	1,872.04	44,715.7	4.19%
SWEETWND_WND1	302	4,045.35	126,648	3.19%	63	1,117.28	18,358.3	6.09%
SWEETWND4_WND5	302	8,121.30	238,098	3.41%	63	1,623.90	35,395.9	4.59%
TKWSW_CHAMPION	302	16,780.05	307,315	5.46%	63	4,416.62	48,002.5	9.20%
TKWSW1_ROSCOE	302	25,901.47	659,296	3.93%	63	7,368.38	90,054.5	8.18%
TRENT_TRENT	302	17,181.82	480,340	3.58%	63	4,281.96	69,118.7	6.20%
WEC_WECG1	302	8,247.87	227,304	3.63%	63	3,497.50	32,872.4	10.64%
DELAWARE_WIND_NWP	*302*	*1,848.17*	*53,626*	*3.45%*	*61*	505.42	5,902.6	*8.56%*
INDNNWP_INDNNWP	*300*	*11,098.69*	*256,350*	*4.33%*	*63*	*3,566.46*	*37,758.7*	*9.45%*
KUNITZ_WIND_LGE	*302*	*1,668.25*	*37,111*	*4.50%*	*60*	*421.65*	*3,576.0*	*11.79%*
SGMTN_SIGNALMT	*302*	*4,067.76*	*101,964*	*3.99%*	*63*	*1,146.33*	*16,119.0*	*7.11%*
SW_MESA_SW_MESA	*302*	*8,663.49*	*226,536*	*3.82%*	*63*	*2,800.20*	*33,249.0*	*8.42%*
WOODWRD1_WOODWRD1	*300*	*7,761.16*	*226,387*	*3.43%*	*63*	*2,592.11*	*31,268.0*	*8.29%*
WOODWRD2_WOODWRD2	*300*	*6,935.98*	*213,031*	*3.26%*	*63*	*2,335.29*	*29,436.3*	*7.93%*

4 DEGRADATION ANALYSIS FOR WIND FARMS

The analysis contained in this section is an update of the work reported in the 2009 annual report in response to a request by the TCEQ to determine what amounts of degradation could be observed in the measured power from Texas wind farms. Currently, the TCEQ uses a very conservative 5% degradation per year for the power output from a wind farm when making future projections from existing wind farms. Accordingly, the TCEQ asked the ESL to evaluate any observed degradation from the measured data for Texas wind farms. To accomplish this, nine wind farms (12 sites) from 2002 to 2008, two wind farms from 2004 to 2008 and four new wind farms from 2006 to 2008 (Buffalo Gap, Callahan Divide Wind, Horse Hollow Phase 1 and Sweetwater Wind 2) were evaluated with a total capacity of 1754.6 MW.

In this analysis, a sliding statistical index was established for each site that uses 10th, 25th, 50th, 75th, 90th, and 99th percentiles of the hourly power generation over a 12-month sliding period[3], as well as mean, minimum and maximum hourly power generation of the same 12-month period. These indices are then displayed using one data symbol for each 12-month slide, beginning from the first 12-month period until the last 12-month period for each of the wind farms, as shown from Figure 4-1 and Figure 4-14. The 90th percentile values were chosen to present the degradation for each wind farm[4]. In addition, our analysis revealed that the maximum hourly power generation over a 12-month period was also a useful index to watch, since this facilitated a way to see if there was major operation change (i.e., shut down of wind turbines) during the studied time period.

Table 4-1 presents the summary of the degradation analysis for the eleven wind farms (18 sites). of the 18 sites analyzed, thirteen sites showed an increase when one compares the 90th percentile of whole period to the 90th percentile of the first 12-month period, ranging from 1.5% to 27.3%. The remaining five sites showed a decrease from -1.2% to -23.7%. The weighted average of this increase across all wind farms studied is 10.3% (positive), which indicates that no degradation was observed from the aggregate energy production from these wind farms over the studied operation period.

Table 4-2 and Figure 4-19 show the design capacity, the maximum and minimum of the observed maximum hourly wind power over the sliding 12-month period, and the observed maximum hourly wind power for the last 12-month period for the studied wind farms. It is interesting to note that the observed maximum hourly wind power generation is slightly lower than the design/announced capacity for the majority of the sites.

[3] To calculate this, the hourly data for the 12-month period is converted into quartiles, and those quartiles are recorded in a table. Then, the oldest month is dropped from the dataset and a new month is added, and the quartiles recalculated and recorded, etc.
[4] The choice of the 90th percentile is consistent with the recommendation by Abushakra, B., Haberl, J., Claridge, D. 2004. "Overview of Literature on Diversity Factors and Schedules for Energy and Cooling Load Calculations (1093-RP)," *ASHRAE Transactions-Research,* Vol. 110, Pt. 1 (February), pp. 164-176; and in Claridge, D., Abushakra, B., Haberl, J. 2003. "Electricity Diversity Profiles for Energy Simulation of Office Buildings (1093-RP)," *ASHRAE Transactions-Research*, Vol. 110, Pt. 1 (February), pp. 365-377.

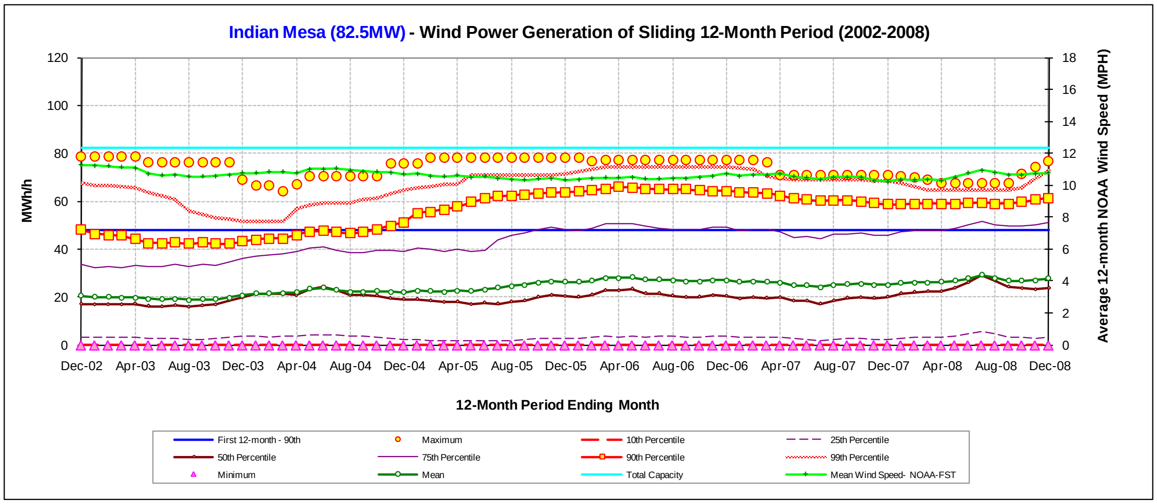


Figure 4-1: Sliding 12-month Hourly Wind Power Generation for Indian Mesa

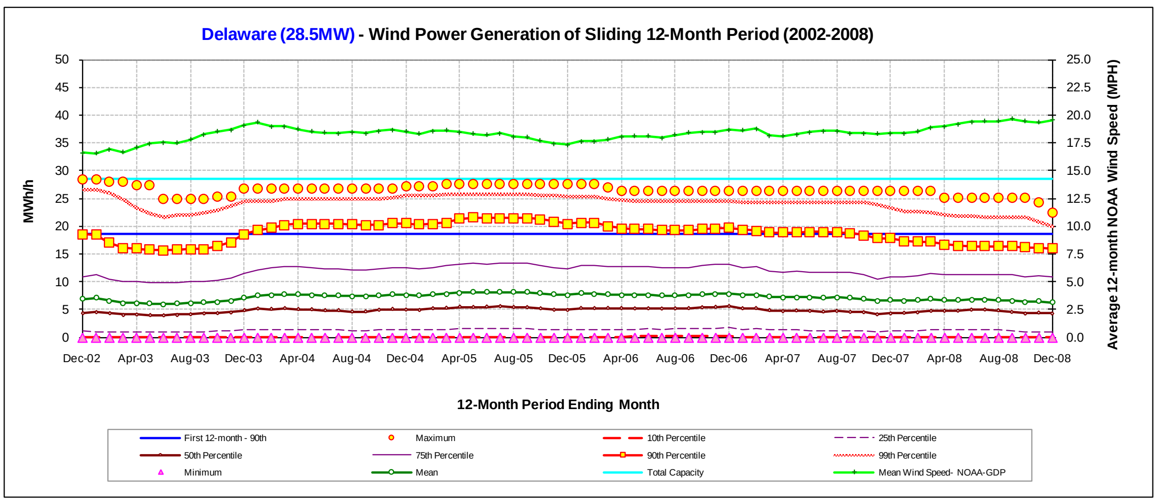


Figure 4-2: Sliding 12-month Hourly Wind Power Generation for Delaware

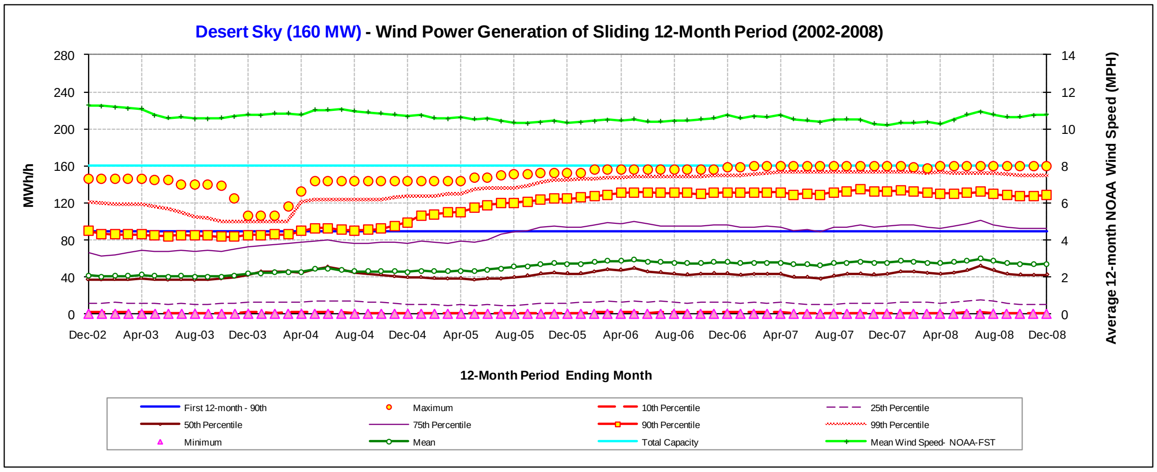


Figure 4-3: Sliding 12-month Hourly Wind Power Generation for Desert Sky

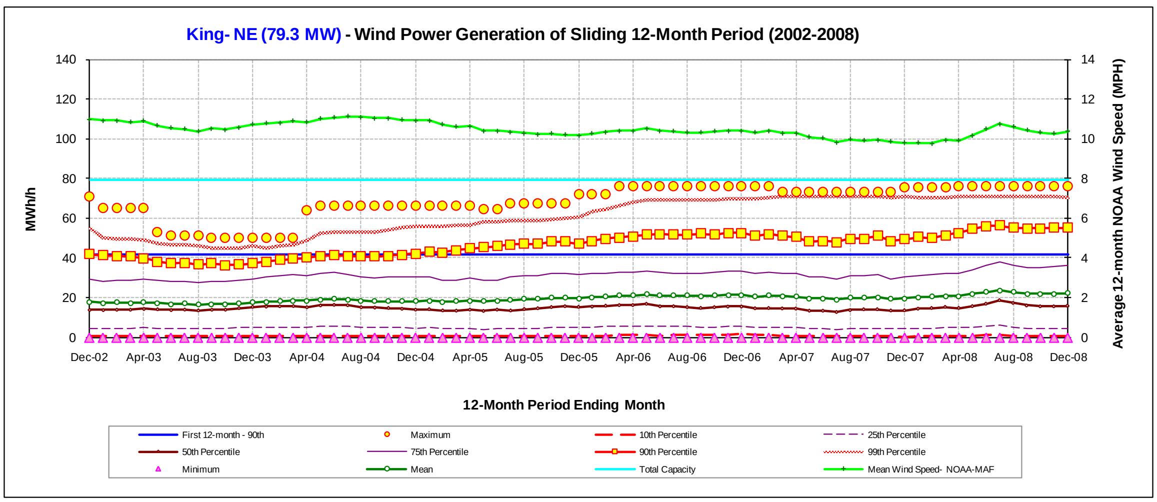


Figure 4-4: Sliding 12-month Hourly Wind Power Generation for King Mountain – NE

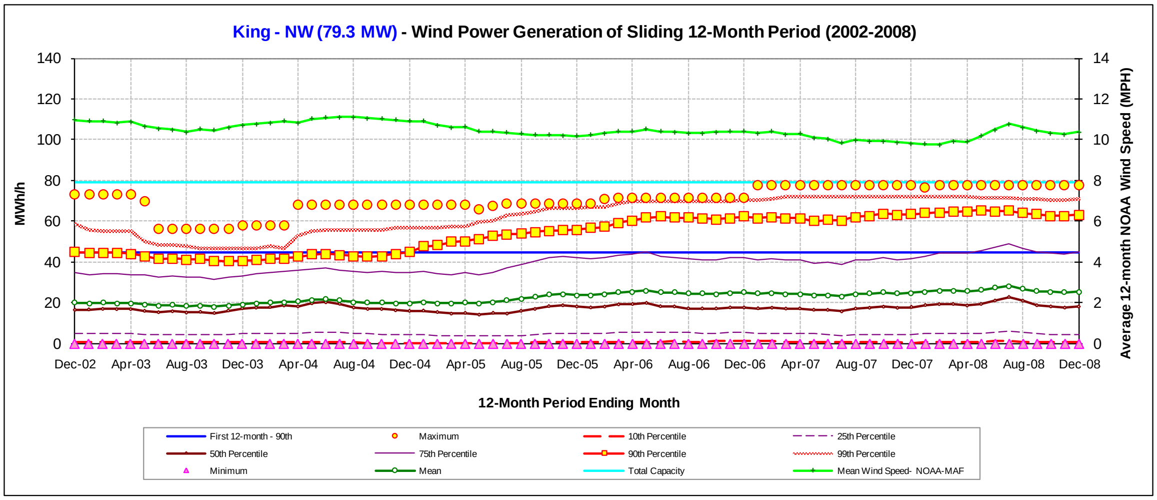


Figure 4-5: Sliding 12-month Hourly Wind Power Generation for King Mountain – NW

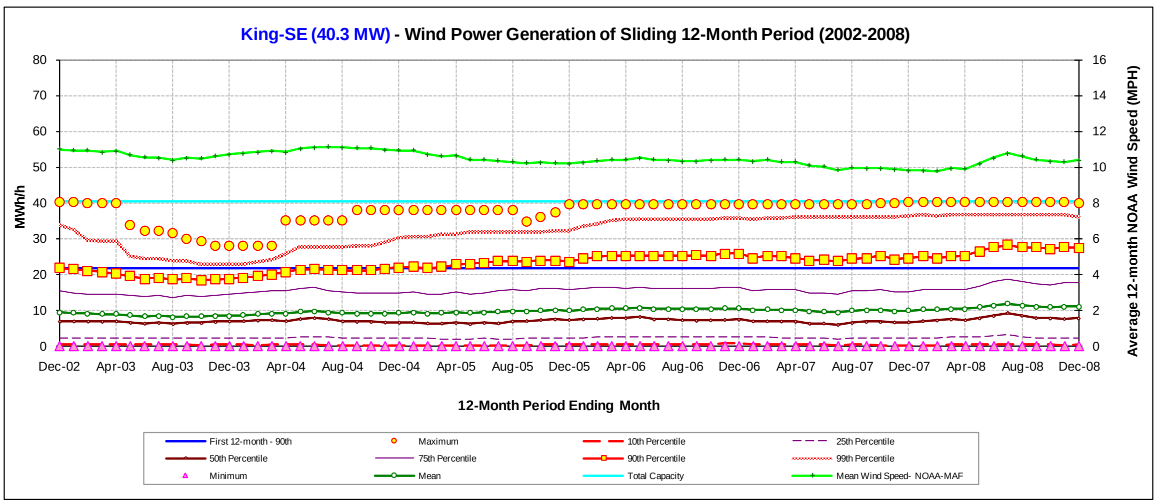


Figure 4-6: Sliding 12-month Hourly Wind Power Generation for King Mountain – SE

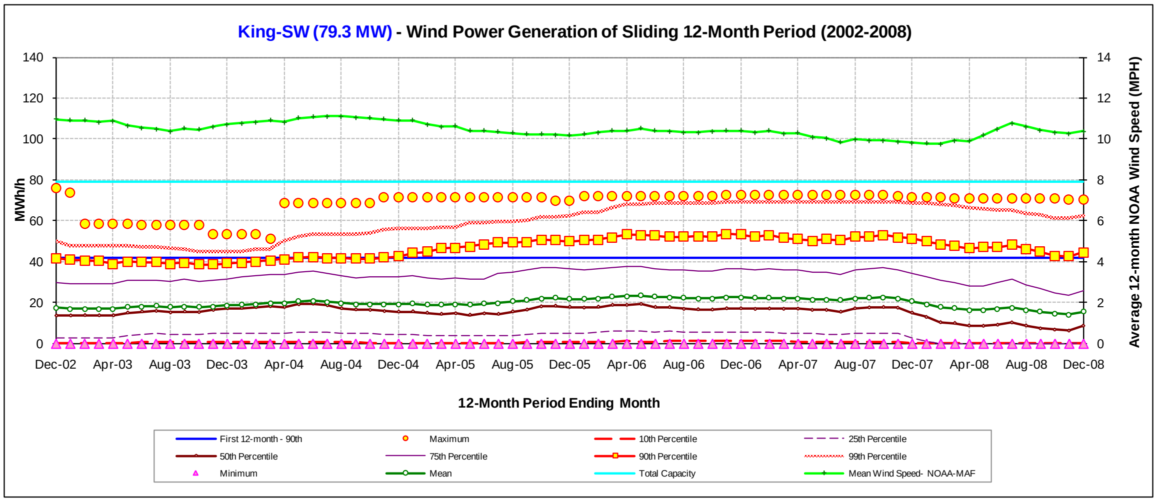


Figure 4-7: Sliding 12-month Hourly Wind Power Generation for King Mountain – SW

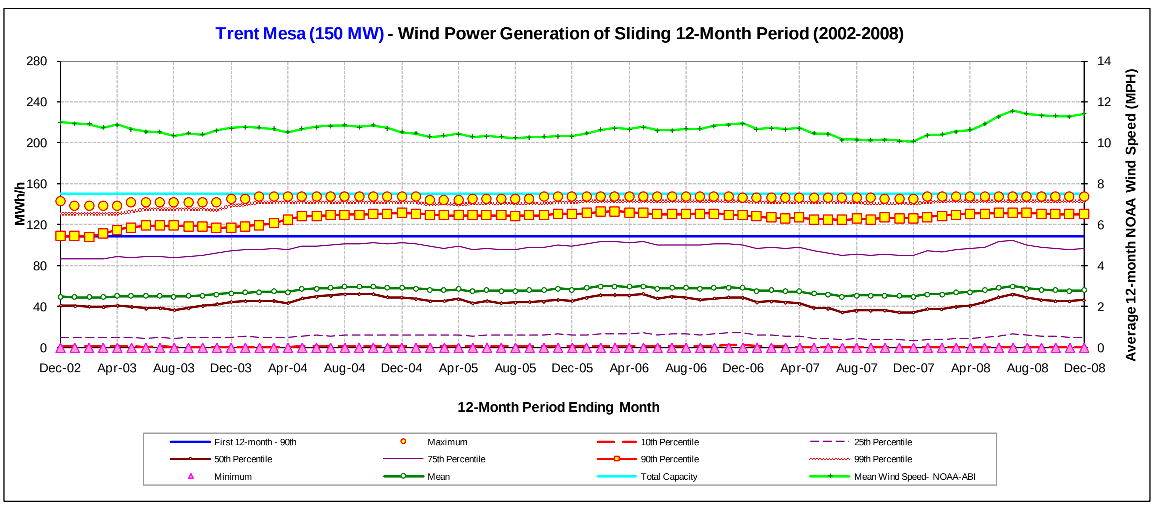


Figure 4-8: Sliding 12-month Hourly Wind Power Generation for Trent Mesa.

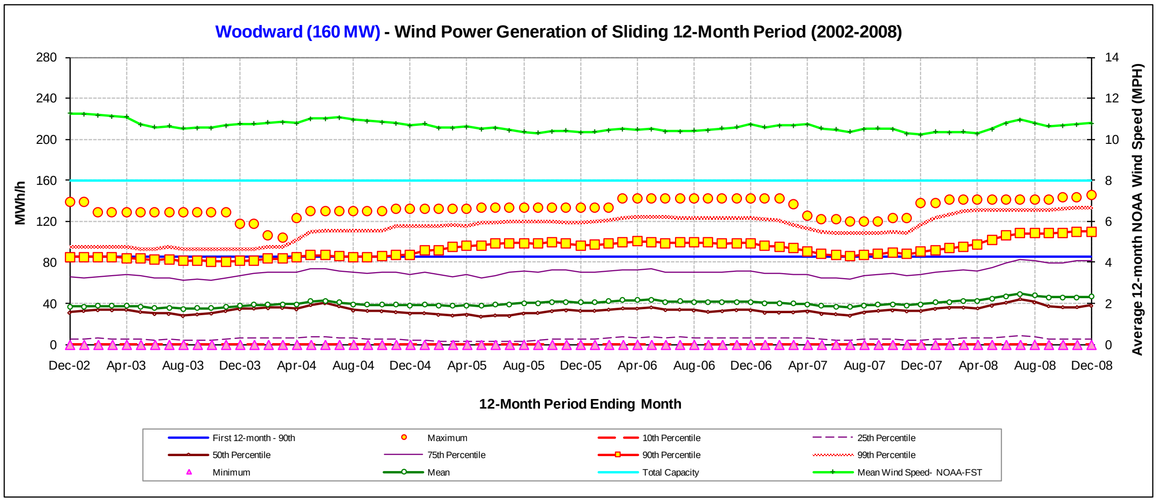


Figure 4-9: Sliding 12-month Hourly Wind Power Generation for Woodward

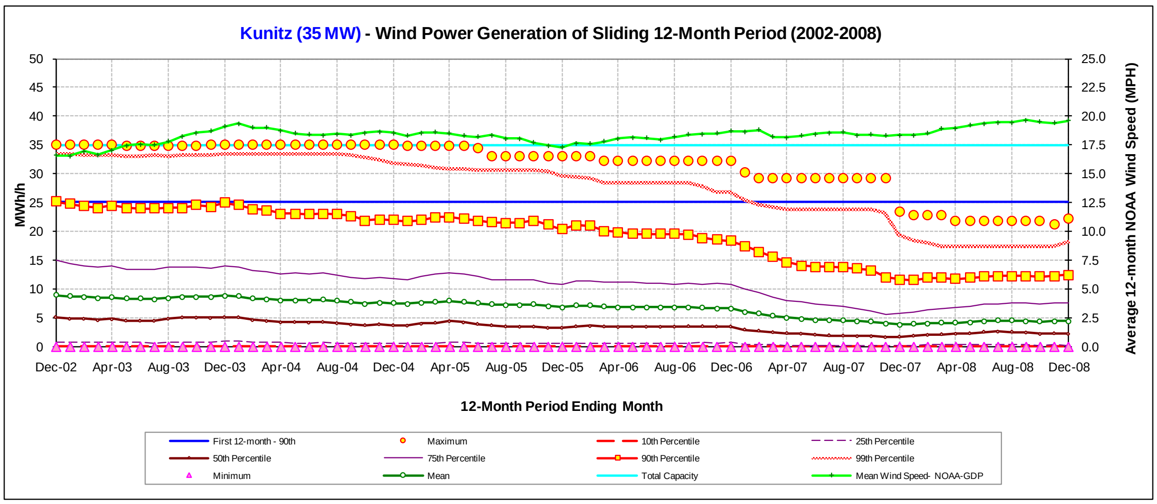


Figure 4-10: Sliding 12-month Hourly Wind Power Generation for Kunitz

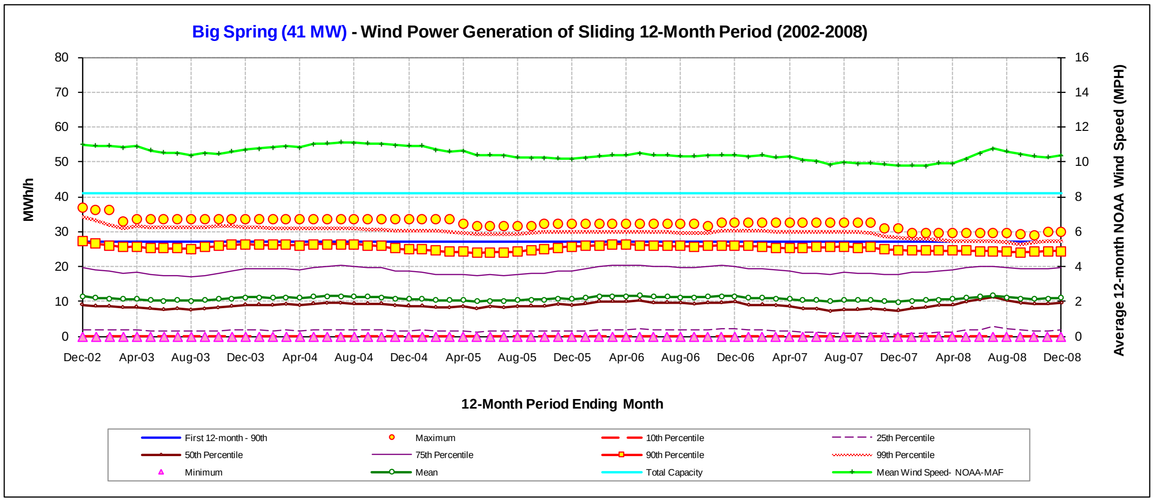


Figure 4-11: Sliding 12-month Hourly Wind Power Generation for Big Spring

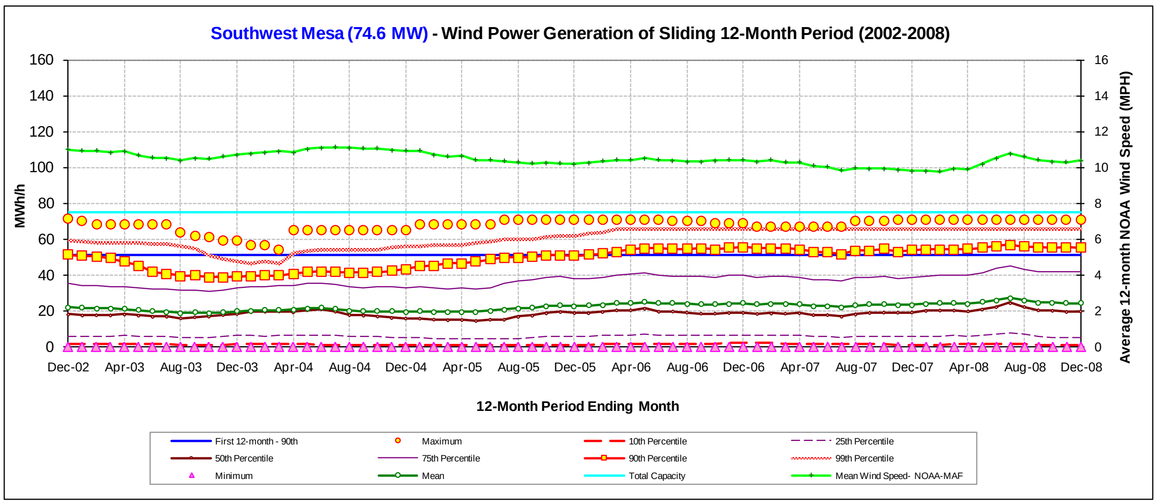


Figure 4-12: Sliding 12-month Hourly Wind Power Generation for Southwest Mesa

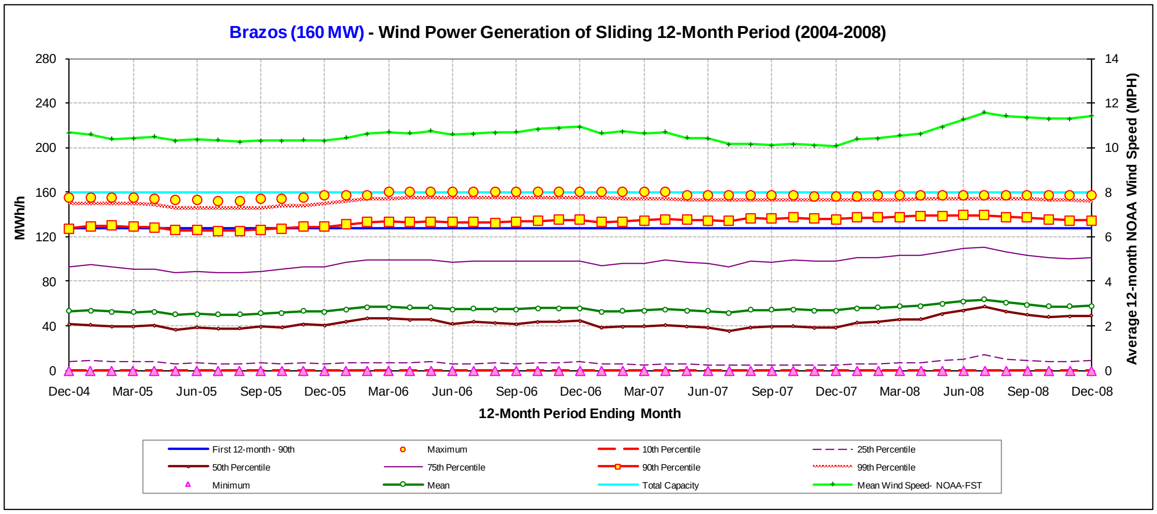


Figure 4-13: Sliding 12-month Hourly Wind Power Generation for Brazos Wind Ranch

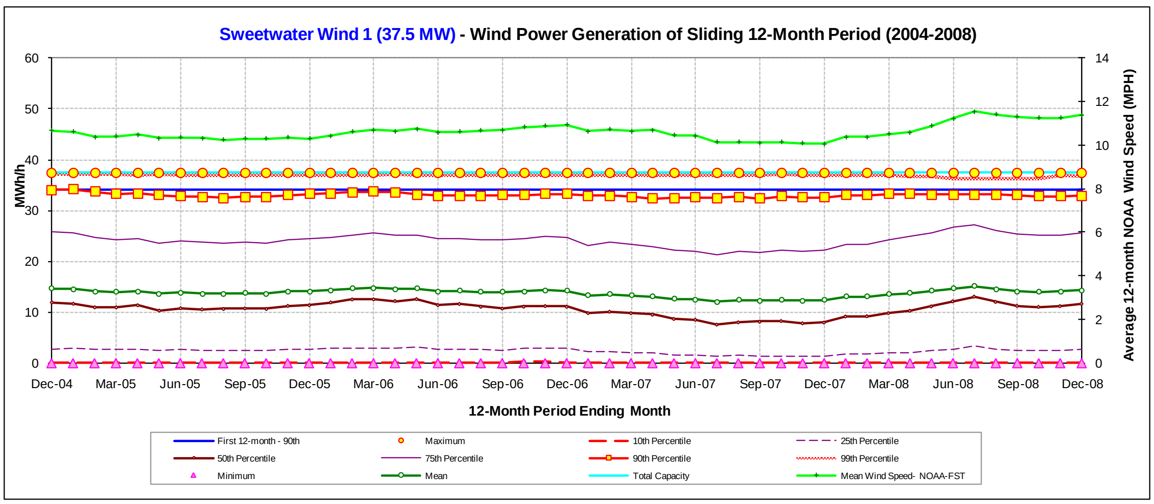


Figure 4-14: Sliding 12-month Hourly Wind Power Generation for Sweetwater Wind 1

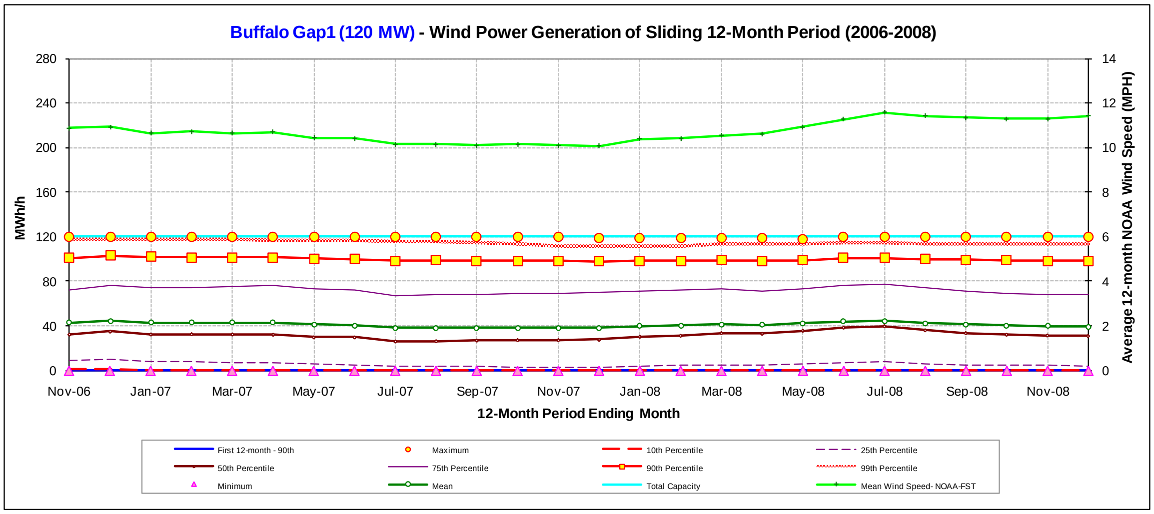


Figure 4-15: Sliding 12-month Hourly Wind Power Generation for Buffalo Gap 1

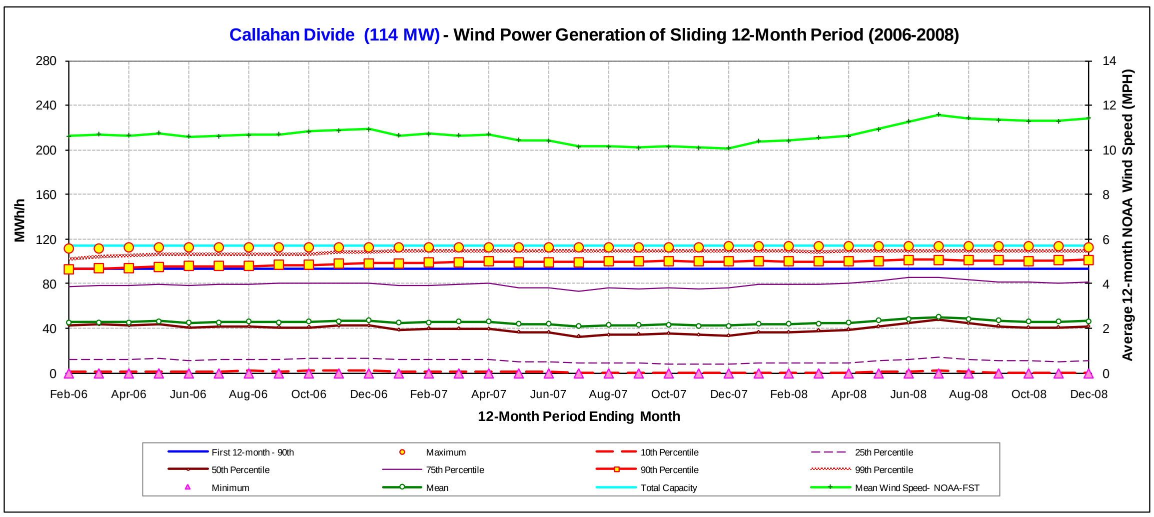


Figure 4-16: Sliding 12-month Hourly Wind Power Generation for Callahan Divide Wind

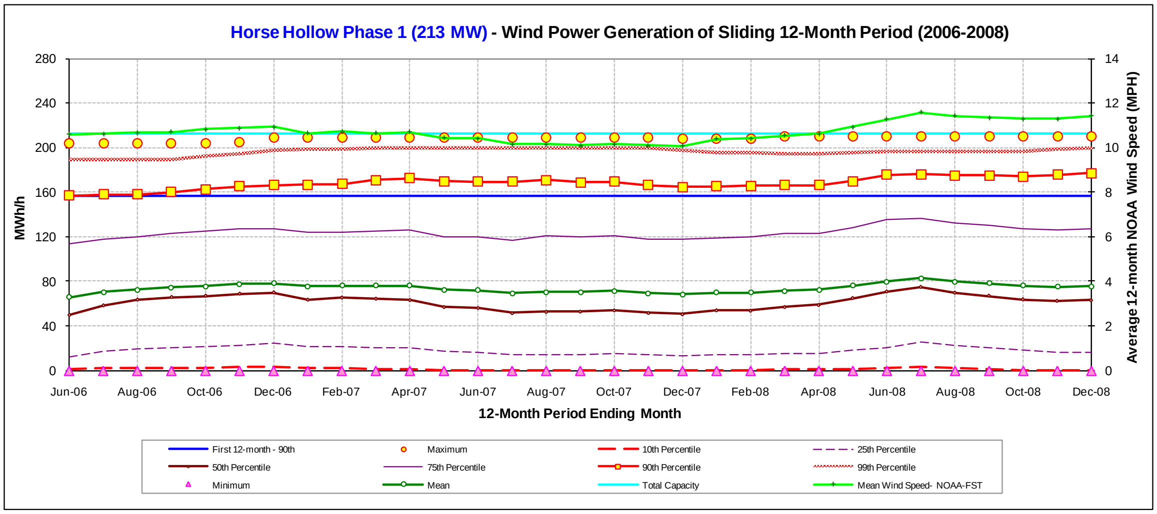


Figure 4-17: Sliding 12-month Hourly Wind Power Generation for Horse Hollow Phase 1

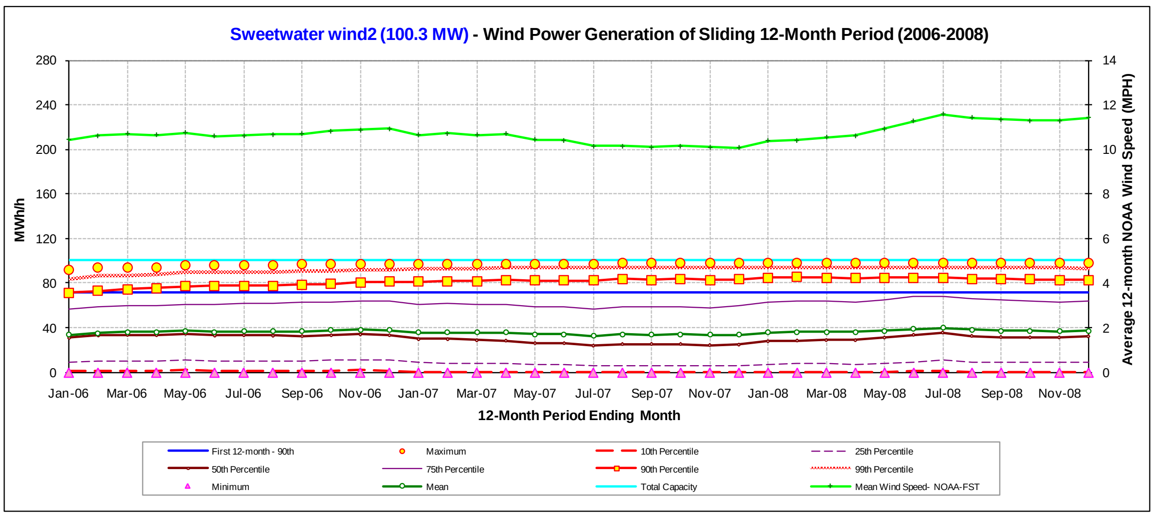


Figure 4-18: Sliding 12-month Hourly Wind Power Generation for Sweetwater Wind 2

Table 4-1: Summary of 90th Percentile Hourly Wind Power Analysis for FourteenWind Farms in Texas

Wind Farm	First 12-mo 90th Percentile Hourly Wind Power		Average of the Sliding 12-mo 90th Precentile Hourly Wind Power		Minimum of the Sliding 12-mo 90th Precentile Hourly Wind Power		Maximum of the Sliding 12-mo 90th Precentile Hourly Wind Power		No. of Month of Data	Capacity (MW)
	First 12-mo Ending Mo.	MW	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo	MW	% Diff. vs. First 12-mo		
Brazos Wind Ranch	Dec-04	127.5	133.3	4.5%	125.1	-1.9%	139.3	9.2%	60	160
Indian Mesa	Dec-02	48.0	55.9	16.5%	42.1	-12.2%	66.0	37.5%	84	82.5
Delaw are	Dec-02	18.5	18.8	1.5%	15.6	-15.5%	21.5	16.1%	84	28.5
Desert Sky	Dec-02	89.0	113.4	27.3%	83.1	-6.7%	134.4	50.9%	84	160
King Mountain-NE	Dec-02	41.8	46.5	11.1%	36.3	-13.2%	56.4	34.8%	84	79.3
King Mountain-NW	Dec-02	44.7	53.8	20.4%	40.2	-10.1%	65.3	46.1%	84	79.3
King Mountain-SE	Dec-02	21.6	23.2	7.2%	18.4	-15.0%	28.1	29.8%	84	40.3
King Mountain-SW	Dec-02	41.6	46.4	11.6%	38.4	-7.6%	53.4	28.5%	84	79.3
Sw eetw ater Wind 1	Dec-04	34.1	33.0	-3.1%	32.3	-5.0%	34.2	0.4%	60	37.5
Trent	Dec-02	108.8	126.2	15.9%	108.2	-0.6%	132.8	22.0%	84	150
Woodw ard	Dec-02	85.3	92.7	8.7%	80.4	-5.7%	109.7	28.6%	84	160
Kunitz	Dec-02	25.2	19.2	-23.7%	11.5	-54.5%	25.2	0.0%	84	35
Big Spring	Dec-02	27.2	25.4	-6.8%	23.9	-12.0%	27.2	0.0%	84	41
Southw est Mesa	Dec-02	51.1	49.2	-3.7%	38.5	-24.6%	56.5	10.6%	84	74.6
Buffalo Gap 1	Nov-06	100.9	99.6	-1.2%	97.9	-2.9%	102.8	1.9%	37	120
Callahan Divide Wind	Feb-06	93.3	98.8	5.8%	93.3	0.0%	101.5	8.8%	46	114
Horse Hollow Phase 1	Jun-06	157.0	168.2	7.2%	157.0	0.0%	177.3	12.9%	42	213
Sw eetw ater Wind 2	Jan-06	71.4	81.2	13.9%	71.4	0.0%	85.3	19.5%	47	100.3
Weighted Average:				**10.3%**		**-9.4%**		**26.3%**	**Total:**	**1754.6**

Table 4-2: Summary of Maximum Hourly Wind Power Analysis for FourteenWind Farms in Texas

Brazos Wind Ranch	160	160.0	152.5	157.0	0.0	3.0
Indian Mesa	82.5	78.5	63.9	76.7	4.0	1.8
Delaw are	28.5	28.5	22.3	22.3	0.0	6.2
Desert Sky	160	159.6	105.8	159.4	0.4	0.2
King Mountain-NE	79.3	76.2	49.8	75.8	3.1	0.4
King Mountain-NW	79.3	77.6	56.2	77.5	1.7	0.1
King Mountain-SE	40.3	40.0	27.8	39.9	0.3	0.1
King Mountain-SW	79.3	75.9	51.2	70.2	3.4	5.7
Sw eetw ater Wind 1	37.5	37.5	37.5	37.5	0.0	0.0
Trent	150	147.6	138.8	147.4	2.4	0.2
Woodw ard	160	145.5	104.1	145.5	14.5	0.0
Kunitz	35	35.0	21.2	22.2	0.0	12.8
Big Spring	41	37.0	29.1	29.8	4.0	7.2
South Mesa	74.6	71.2	53.8	70.7	3.4	0.5
Buffalo Gap 1	120	120.0	118.2	119.8	0.0	0.2
Callahan Divide Wind	114	113.9	111.2	112.9	0.1	1.0
Horse Hollow Phase 1	213	209.9	204.1	209.9	3.1	0.0
Sw eetw ater Wind 2	100.3	98.0	91.8	97.6	2.3	0.4
Total:	**1754.6**	**1711.9**	**1439.3**	**1672.1**	**42.7**	**39.8**

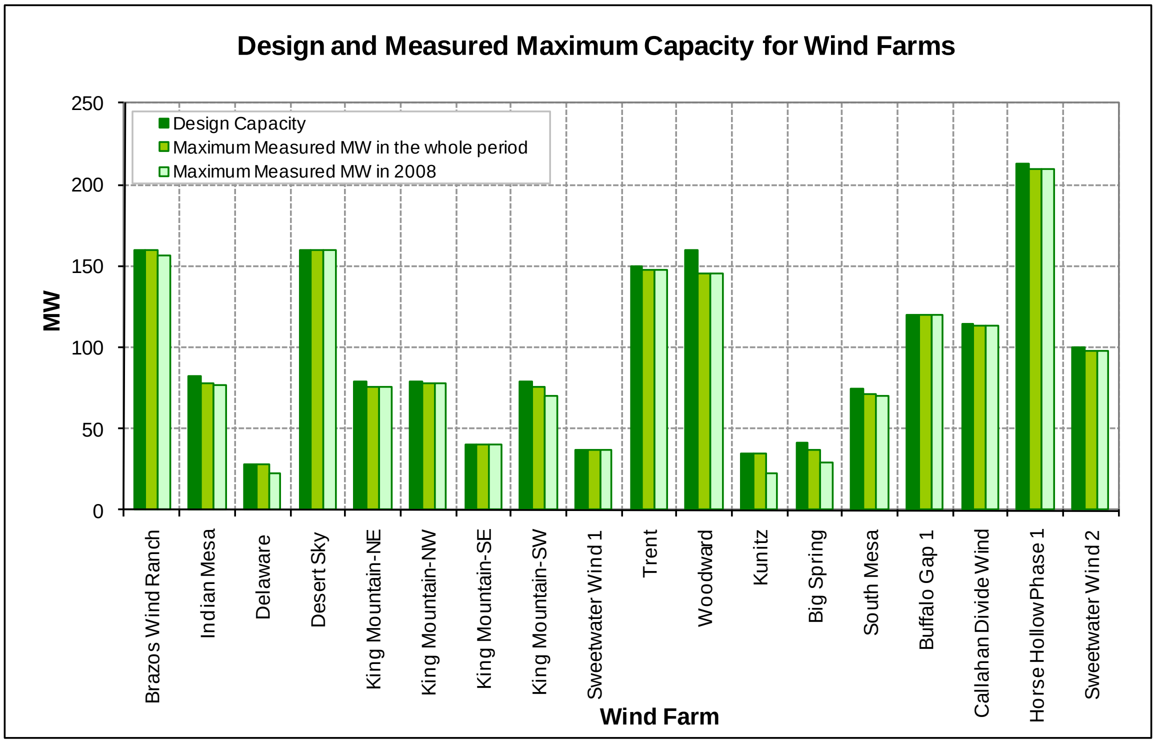


Figure 4-19: Design and Measured Maximum Capacity for Fourteen Wind Farms

5 CALCULATING NO_X EMISSIONS REDUCTION FROM WIND POWER

5.1 Calculation of NOx Emissions from Wind Power Using 2007 eGRID

The Energy Systems Laboratory has worked closely with the TCEQ and EPA to develop creditable procedures for calculating NOx reductions from electricity savings using the EPA's Emissions and Generation Resource Integrated Database (eGRID). Calculating NOx emissions from wind power to counties within the ERCOT region encounters some major complications. First, electricity can be generated from different primary energy sources which results in very different NOx emissions. Second, the combination of generation resources used to meet loads may vary during each day or different seasons. Third, electricity is transported over long distances by complex, interconnected transmission and distribution systems. Therefore, the generation source related to electricity usage can be difficult to trace and may occur far from the jurisdiction in which that energy is consumed. Due to the limited availability of public data and the fact that the eGRID database aggregates the emissions on the basis of PCAs[5], the decision was made by the TCEQ and EPA to calculate and assign emissions, according to the PCA where it was generated. A similar decision has been used in California (Marnay et al. 2002). This assumption does not address the deregulation of generation, but provides a good estimation of the emissions reduction from wind power electric production for the base year of 1999, which is currently in use by the TCEQ using the EPA's eGRID.

The procedure presented in this section calculates annual and peak-day, county-wide NO_x reductions from electricity savings from wind projects implemented in the Power Control Areas in ERCOT listed in the EPA's eGRID. For this purpose, a special version of eGRID[6] was developed by the EPA for the TCEQ that reflects the 2007 electricity and pollution from electric utilities in ERCOT. The NOx production for each power plant is provided from the 2007 eGRID database for ten electric utility suppliers. This eGRID matrix was utilized to assign the power plant used by the utility provider, once the utility provider had been chosen for a given county. Figure 5-1 shows a snapshot of the NOx emission distribution among Texas counties from generating one mega-watt-hour of electricity in the power control area of AEP-West, which was derived from the 2007 Annual eGRID table. For example, the counties marked in red show higher NOx emissions of above 0.08 lbs/MWh. The counties marked in green were least impacted by the NOx emissions (less than 0.0005 lbs/MWh) from the power plants assigned to AEP-West. Figure 5-2 and Figure 5-3 show the same county-wide NOx emissions distribution from TXU and LCRA.

To calculate the NOx emissions reduction from the wind projects within the ERCOT region, the total MWh wind power for each Power Control Area are summarized in Table 5-1. The assignment of PCA to each wind farm was based on the information provided by the PUCT to ESL in 2005 and 2007 as shown in

[5] A Power Control Area (PCA) is defined as one grid region for which one utility controls the dispatch of electricity. Some smaller utilities are embedded in the power control areas of larger utilities. The corresponding PCA for wind farms was obtained from PUCT.
[6] This 2007 eGRID table for Texas was provided by Art Diem of the US EPA and includes emissions values for AEP, Austin Energy, Brownsville Public Utility, LCRA, Reliant, San Antonio Public Service, South Texas Coop, TMPP, TNMP, and TXU.

Table 5-2 and Table 5-3, respectively. The total MWh production in each PCA was input in the corresponding cells in the eGRID table to calculate the total annual and OSD emissions reduction for the entire ERCOT region (Table 5-4 and Table 5-5).

According to the developed models, the total MWh savings in the base year 1999 for the wind farms within the ERCOT region is 18,808,351 MWh and 41,403 MWh/day in the Ozone Season Period. The total NOx emissions reductions across all the counties amount to 10,958 tons/yr and 24 tons/day for the Ozone Season Period. The distribution of the NOx emissions reduction in the counties within the ERCOT region is shown in Figure 5-4, Figure 5-5, Figure 5-6, and Figure 5-7. Based on the 2007 eGRID, it is shown that the counties in the gulf coast area will get emissions benefit from the wind farms located in the west. Figure 5-8 shows the average modeled power flows during 2006 for each of the Commercially Significant Constraints from ERCOT[7]. Based on modeled flows, Houston is a significant importer from the 'North Zone' and the 'South Zone,' while the 'South Zone' and the 'Northeast Zone' export significant amounts of power. So, any modifications on the generation patterns in the north area could affect the generation on the South area (Gulf coast) which has a larger emissions rate than the northern counterpart, thus giving a major emissions reduction impact. Therefore, we believe the distribution of electricity is adequately reflected in the current choice of the PCAs continued in the 2007 eGRID.

5.2 Updated Version of eGRID

The ESL has been working with the EPA and the TCEQ on a new version of eGRID for all ERCOT counties in Texas. This new version of eGRID was developed based on the ERCOT congestion management zones (Figure 5-8).[8] It uses a simplified dispatch approach of the ERCOT grid to estimate NOx emission reductions across the ERCOT region in Texas. The simplified dispatch method reduces the generation from plants that are expected to be operating in future years and reduces NOx emissions at these plants by the expected reduction in output emission rate of these plants. This method does not use an electric system planning model, or an electric system dispatch model, which could more fully reflect some of the dynamics of the electricity system than is presented here.

Based on the reduction targets identified by the legislature for investor owned utilities, this study assigns the electric generation reductions at specific fossil fuel fired plants that currently exist and to plants that are scheduled to be online in the years examined in this analysis, 2010 and 2015. This method assigns the potential energy savings targets of each affected investor owned utility in ERCOT, which are then applied to the respective congestion management (CM) zones based on the proportion of the utility's load in each CM zone. Then it applies the energy savings to generation from each CM zone based on year 2007 generation and power flows across these zones. Next, it applies the CM zone specific reductions in generation to each plant within the CM zone based on the amount of the plant's generation that could be affected by energy efficiency measures, which is derived from a function of the plant's capacity factor. Then a plant specific output NOx emission rate is applied to the expected reduction in electric generation. These emission rates are based on year 2005 EPA's eGRID emission rates and TCEQ's most current baseline emissions inventory for year 2005 and for projected year 2018. Finally the plant specific emission reduction is summed to the county level. The potential emissions reductions are presented for each of the investor owned utilities and in aggregate for all five ERCOT utilities under the year 2010 and 2015 energy savings scenarios (Table 5-6 and Table 5-7).

As the TCEQ moves the base year to more recent years, this updated version of eGRID representing the current Texas market may be used to estimate the emissions reduction from wind power in the next year's report.

[7] ERCOT, "2006 State of the Market Report for the ERCOT Wholesale Electricity Markets" Available at: http://www.puc.state.tx.us/WMO/documents/annual_reports/2006annualreport.pdf

[8] Estimation of Annual Reductions of NOx Emissions in ERCOT for the HB3693 Electricity Savings Goal, The United Sates Environmental Protection Agency and the Energy Systems Lab, December 2008

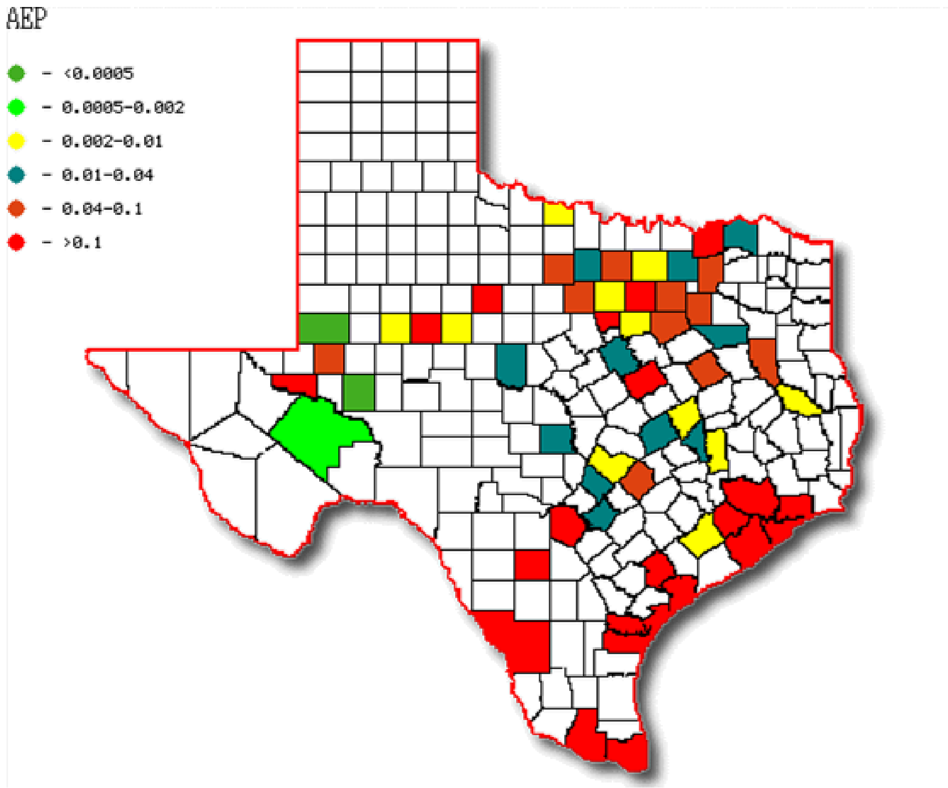


Figure 5-1: NOx Emissions (lbs/MWh) from PCA-AEP West in the 2007 Annual eGRID

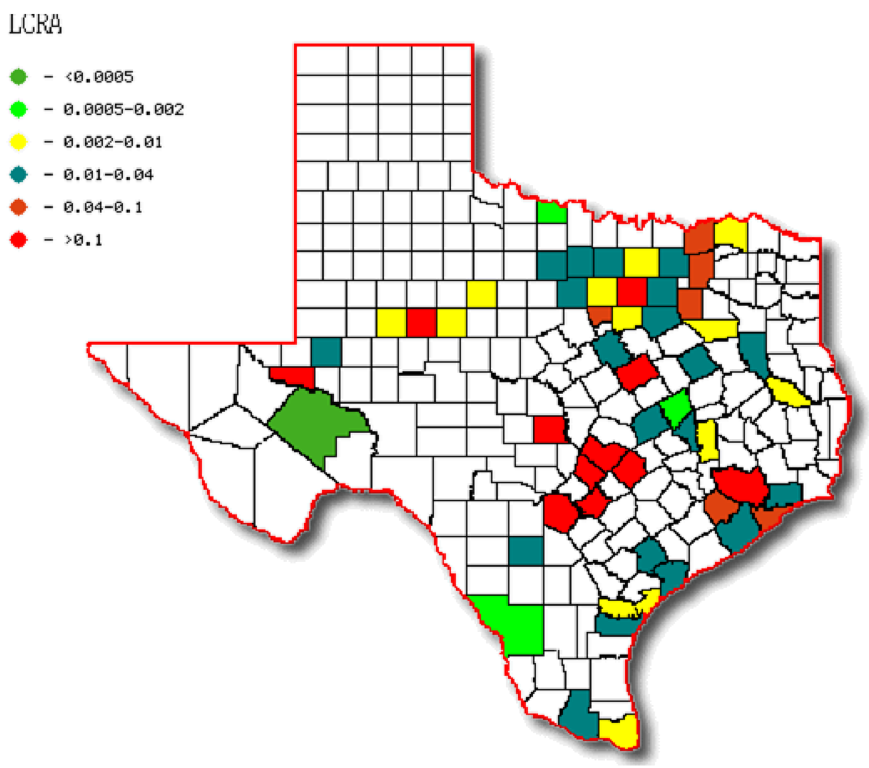


Figure 5-2: NOx Emissions (lbs/MWh) from PCA-LCRA in the 2007 Annual eGRID

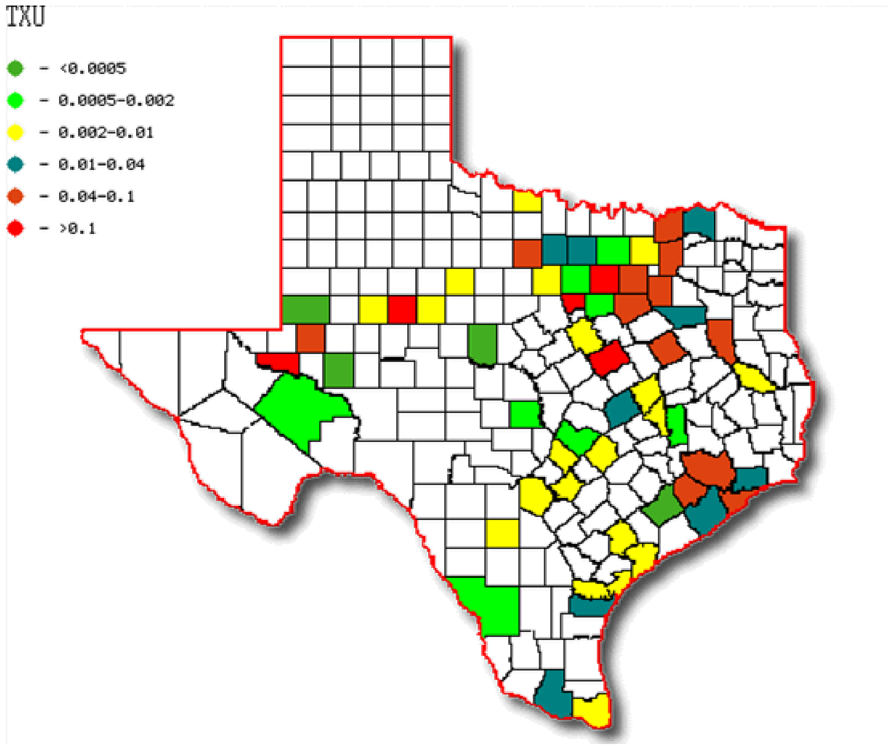


Figure 5-3: NOx Emissions (lbs/MWh) from PCA-TXU in the 2007 Annual eGRID

Table 5-1: Wind Power Production Assigned to Each PCA in the ERCOT Region

PCA	Annual Wind Power (MWh/yr)	OSD Wind Power (MWh/day)
AEP-WEST	7,275,027	18,213
TXU	1,271,399	3,041
LCRA	1,679,976	3,899
Total	10,226,401	25,153

Table 5-2: Wind Farm Information from the PUCT – 2005

Source: http://www.puc.state.tx.us/electric/maps/gentable.pdf

Map No.	Company	Facility	City (County)	Resource	Capacity (MW)	Date in Service	Interconnection	Region	PCA
7	York Research	Big Spring Wind Power	Big Spring (Howard)	Wind	34	Feb-99	TXU	ERCOT	TXU
8	FPL Energy	Southwest Mesa Wind Project	McCamey (Upton)	Wind	75	Jun-99	WTU	ERCOT	AEP-West
9	American National Wind Power	Delaware Mountain Wind Farm	Delaware Mountains (	Wind	30	Jun-99	TXU	ERCOT	TXU
10	York Research	Big Spring Wind Power	Big Spring (Howard)	Wind	6.6	Jun-99	TXU	ERCOT	TXU
33	Orion Energy/American National Win	Indian Mesa I	(Pecos)	Wind	82.5	Jun-01	WTU	ERCOT	AEP-West
35	FPL/Cielo/TXU	Woodward Mountain Ranch	McCamey (Pecos)	Wind	160	Jul-01	WTU	ERCOT	AEP-West
44	AEP	Trent Mesa	Trent Mesa (Nolan)	Wind	150	Nov-01	TXU	ERCOT	TXU
45	AEP	Desert Sky (Indian Mesa II)	Iraan (Pecos)	Wind	160	Dec-01	WTU	ERCOT	AEP-West
46	FPL/Cielo	King Mountain Wind Ranch	McCamey (Upton)	Wind	278	Dec-01	WTU	ERCOT	AEP-West
65	Cielo/Orion/Green Mountain	Brazos Wind Ranch	Fluvana (Scurry)	Wind	160	Dec-03	ONCOR	ERCOT	AEP-West
66	DKR/Babcock&Brown/Catamount	Sweetwater 1	Sweetwater (Nolan)	Wind	37.5	Dec-03	LCRA	ERCOT	LCRA
75	FPL Energy	Callahan Divide Wind Energy C	Abilene (Taylor)	Wind	114	Feb-05	AEP-TNC	ERCOT	AEP-West
Map No.	Company	Facility	City (County)	Resource	apacity (MV	ed Date in	:ted Date in S	Region	
79	Clipper Windpower Dev.	Silver Star Phase I	(Eastland)	Wind	60	2005	5-Jun	ERCOT	TXU
80	DKRW Development	Sweetwater II	Sweetwater (Nolan)	Wind	89	2005	5-Dec	ERCOT	TXU
81	AES Corporation	Buffalo Gap	Abilene (Taylor)	Wind	120	1Q-05	4Q-05	ERCOT	AEP-West
84	Orion Energy		(Culberson)	Wind	175	NA	6-Dec	ERCOT	TXU

Capacity (MW)	PCA (1998 Designation)	Percent of Total Capacity
1149.5	AEP-West	66.38%
37.5	LCRA	2.17%
544.6	TXU	31.45%
1731.6	*TOTAL*	*100.00%*

Table 5-3: Wind Farm Information from the PUCT – 2010

Company	Facility	City	County	Resource	Capacity (MW)	Status	In Service	Intercon-nection	Region
LG&E	Texas Wind Pow er Project		Culberson	Wind	35	Completed	Oct-95	TXU, LCRA	ERCOT
York Research	Big Spring Wind Pow er	Big Spring	How ard	Wind	34	Completed	Feb-99	TU	ERCOT
York Research	Big Spring Wind Pow er	Big Spring	How ard	Wind	7	Completed	Jun-99	TXU	ERCOT
FPL Energy	Southw est Mesa Wind Project	McCamey	Upton	Wind	75	Completed	Jun-99	WTU	ERCOT
American National Wind Pow er	Delaw are Mountain Wind Farm		Culberson	Wind	30	Completed	Jun-99	TXU	ERCOT
Cielo/El Paso Electric	Hueco Mountain Wind Ranch	Hueco Mtn.	El Paso	Wind	1	Completed	Apr-01	EPE	WSCC
Orion Energy/American National Wind Pow er	Indian Mesa		Pecos	Wind	83	Completed	Jun-01	WTU	ERCOT
FPL/Cielo/TXU	Woodw ard Mountain Ranch	McCamey	Pecos	Wind	160	Completed	Jul-01	WTU	ERCOT
AEP	Trent Mesa	Sw eetw ater	Nolan	Wind	150	Completed	Nov-01	TXU	ERCOT
AEP	Desert Sky (Indian Mesa II)	Iraan	Pecos	Wind	160	Completed	Dec-01	WTU	ERCOT
FPL/Cielo	King Mountain Wind Ranch	McCamey	Upton	Wind	278	Completed	Dec-01	WTU	ERCOT
Shell Wind Energy	Llano Estacado Wind Ranch	White Deer	Carson	Wind	79	Completed	Jan-02	SPS	SPP
Cielo/Orion/Green Mountain	Brazos Wind Ranch	Fluvana	Scurry	Wind	160	Completed	Dec-03	ONCOR	ERCOT
Aeolus Wind			Hansford	Wind	3	Completed	Dec-03	SPS	SPP
DKR Development	Sw eetw ater Wind 1	Sw eetw ater	Nolan	Wind	38	Completed	Dec-03	LCRA	ERCOT
DKRW Development	Sw eetw ater Wind 2	Sw eetw ater	Nolan	Wind	92	Completed	Feb-05	LCRA	ERCOT
DKRW Energy	Sw eetw ater Wind 3 (Cottonw ood Creek)	Sw eetw ater	Nolan	Wind	135	Completed	Dec-05	LCRA	ERCOT
DKRW/BabcockBrow n	Sw eetw ater Wind 4 (Cottonw ood Creek)	Sw eetw ater	Nolan	Wind	241	Completed	May-07	LCRA	ERCOT
DKRW/BabcockBrow n	Sw eetw ater Wind 5	Sw eetw ater	Nolan	Wind	80	Completed	Dec-07	LCRA	ERCOT
FPL Energy	Callahan Divide Wind Energy Center	Abilene	Taylor	Wind	114	Completed	Feb-05	AEP-TNC	ERCOT
AES Seaw est	Buffalo Gap 1	Abilene	Taylor	Wind	120	Completed	Sep-05	AEP/TNC	ERCOT
AES	Buffalo Gap 2 (Cirello 1)	Abilene	Taylor	Wind	233	Completed	Aug-07	AEP/TNC	ERCOT
AES	Buffalo Gap 3		Taylor	Wind	170	Completed	Apr-08	AEP/TNC	ERCOT
FPL Energy	Horse Hollow Phase 1	Abilene	Taylor	Wind	213	Completed	Oct-05	AEP/TNC	ERCOT
FPL Energy	Horse Hollow Phase 2	Abilene	Taylor	Wind	224	Completed	May-06	AEP/TNC	ERCOT
FPL Energy	Horse Hollow Phase 3	Abilene	Taylor	Wind	299	Completed	Sep-06	AEP/TNC	ERCOT
FPL Energy	Red Canyon 1		Borden	Wind	84	Completed	May-06	BEPC	ERCOT
Airtricity	Forest Creek Wind Farm		Sterling	Wind	124	Completed	Dec-06	TXU-ED	ERCOT
Airtricity	Sand Bluff Wind Farm		Sterling	Wind	90	Completed	Dec-06	TXU-ED	ERCOT
Edison Mission Group	Wildorado Wind Ranch	Wildorado	Oldham	Wind	161	Completed	Apr-07	SPS	SPP
Invenergy	Camp Springs Wind Energy Center		Scurry	Wind	130	Completed	Jul-07	Oncor	ERCOT
Invenergy	Camp Springs Energy expansion		Scurry	Wind	120	Completed	Jun-08	Oncor	ERCOT
FPL Energy	Capricorn Ridge Wind		Sterling	Wind	364	Completed	Sep-07	LCRA	ERCOT
FPL Energy	Capricorn Ridge Wind exp.		Sterling	Wind	298	Completed	May-08	LCRA	ERCOT
Gamesa Energy	Barton Chapel Wind 1		Jack	Wind	120	Completed	Dec-07	Oncor	ERCOT
Enel North America/WKN USA	Snyder Wind Project	Snyder	Scurry	Wind	63	Completed	Dec-07	BCEC	ERCOT
Horizon Wind Energy	Lone Star - Mesquite Wind		Shackleford	Wind	200	Completed	Dec-07	Oncor	ERCOT
Horizon Wind Energy	Lone Star - Post Oak Wind		Shackleford	Wind	200	Completed	May-08	Oncor	ERCOT
Renew able Energy Systems	Whirlw ind	Floydada	Floyd	Wind	60	Completed	Dec-07	AEP	ERCOT
Invenergy	Stanton Wind Energy		Martin	Wind	120	Completed	Jan-08	Oncor	ERCOT
Airtricity	Champion Wind Farm		Scurry	Wind	126	Completed	Jan-08	Oncor	ERCOT
Airtricity	Roscoe Wind Farm 1		Scurry	Wind	209	Completed	Jan-08	Oncor	ERCOT
BP/Clipper Windpow er	Silver Star Phase I		Erath	Wind	60	Completed	Mar-08	Oncor	ERCOT
Edison Mission Group	Goat Wind		Sterling	Wind	80	Completed	Apr-08	LCRA	ERCOT
Edison Mission Group	Goat Wind Phase 2		Sterling	Wind	70	Completed	Apr-09	LCRA	ERCOT
Invenergy	McAdoo Wind Energy		Dickens	Wind	150	Completed	May-08	AEP	ERCOT
Airtricity	Panther Creek		How ard	Wind	143	Completed	Jul-08	Oncor	ERCOT
Duke Energy	Ocotillo Windpow er 1		How ard	Wind	59	Completed	Aug-08	Oncor	ERCOT
BP Alt. Energy - NRG	Sherbino Mesa Wind Farm		Pecos	Wind	150	Completed	Sep-08		ERCOT
Babcock & Brow n	South Trent Wind Farm		Taylor	Wind	101	Completed	Oct-08	Oncor	ERCOT
FPL Energy	Wolf Ridge Windfarm		Cooke	Wind	113	Completed	Oct-08		ERCOT
Babcock & Brow n	Gulf Wind 1		Kenedy	Wind	283	Completed	Nov-08	AEP/TCC	ERCOT
E.On Climate & Renew ables	Inadale		Nolan	Wind	197	Completed	Nov-08		ERCOT
E.On Climate & Renew ables	Panther Creek 2		How ard	Wind	115	Completed	Nov-08		ERCOT
E.On Climate & Renew ables	Pyron		Scurry	Wind	249	Completed	Nov-08		ERCOT
Eurus Energy Holdings	Bull Creek Wind Plant		Borden	Wind	180	Completed	Nov-08		ERCOT
Invenergy	Turkey Track Energy Center		Nolan	Wind	170	Completed	Nov-08		ERCOT
NRG Padoma Wind	Elbow Creek Wind		How ard	Wind	117	Completed	Nov-08	Oncor	ERCOT
PPM Energy	Penascal Wind Farm		Kenedy	Wind	202	Completed	Nov-08		ERCOT
Renew able Energy Systems	Hackberry Wind Farm		Shackleford	Wind	165	Completed	Nov-08		ERCOT
Duke Energy	Notrees Windpow er		Ector	Wind	153	Completed	Jan-09		ERCOT
Noble Environmental	Noble Great Plains Windpark		Hansford	Wind	114	Completed	Feb-09		SPP
E.On Climate & Renew ables	Panther Creek 3		Concho	Wind	200	Completed	Aug-09		ERCOT
Valero Energy	Sunray Wind I, II, III		Moore	Wind	50	Completed	Aug-09	SPS	SPP
E.On Climate & Renew ables	Papalote Creek Wind Farm		San Patricio	Wind	180	Completed	Sep-09		ERCOT
Padoma Wind	Langford Wind Pow er		Tom Green	Wind	150	Completed	Oct-09		ERCOT
Third Planet Windpow er	Loraine Windpark		Mitchell	Wind	251	Completed	Oct-09		ERCOT
Deere & Company	JD Wind 1-7, 9-11, Wege	Gruver	Hansford	Wind	190	Completed	Dec-09	SPS	SPP
Babcock & Brow n	Majestic Wind Pow er		Carson	Wind	80	Completed	Dec-09		SPP

Table 5-4: Annual NOx Reductions Using the 1999 Base Year and the 2007 eGrid (25%)

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.008831132	119498.1472	0.010890729	0	0.006522185	0	0.003944232	15478.13139	0.065444292	0	0.014877434	0	0.006262315	0	0.004817148	0	0.121274957	0	0.00816387	11042.79861	146019.0772	73.00953861
	Chambers	0.021762222	294474.7235	0.026955801	0	0.016072371	0	0.009076193	35617.20362	0.164940225	0	0.037472294	0	0.015055623	0	0.009553214	0	0.011518588	0	0.015818592	21396.90209	351488.8292	175.7444146
	Fort Bend	0.070431234	953037.694	0.087239726	0	0.052016606	0	0.029374182	115271.4814	0.533812376	0	0.121275295	0	0.048726002	0	0.030918012	0	0.037278747	0	0.051195276	69248.91202	1137558.087	568.7790437
	Galveston	0.033856739	458131.2433	0.041710519	0	0.025004711	0	0.015351589	60243.39242	0.249587379	0	0.056747051	0	0.024143087	0	0.019297151	0	0.567751219	0	0.032836887	44416.57216	562791.2079	281.395604
	Harris	0.068267332	923756.9417	0.084559408	0	0.050418468	0	0.028471701	111729.9261	0.517411736	0	0.117549281	0	0.047228963	0	0.029968099	0	0.03613341	0	0.049622373	67121.3359	1102608.204	551.3041018
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.002039135	27592.48358	0.003716345	0	0.001505992	0	0.005950953	23352.9953	0.002481478	0	0.000717051	0	0.019166247	0	0.07668094	0	0.00086441	0	0.004000199	5410.840047	56356.31892	28.17815946
	Dallas	0.004539471	61425.68977	0.004683963	0	0.003352602	0	0.00774211	30381.93484	0.002085611	0	0.00068106	0	0.007502816	0	0.026717045	0	0.007524933	0	0.040370454	54606.79625	146414.4209	73.20721043
	Denton	0.00047388	6412.294056	0.000872802	0	0.000349982	0	0.001396994	5482.145846	0.000585443	0	0.000168971	0	0.00454374	0	0.018187155	0	0.000186605	0	0.000849405	1148.941919	13043.38182	6.521690911
	Tarrant	0.012162492	164576.3255	0.012266309	0	0.008982543	0	0.020308652	79696.12305	0.005316504	0	0.001752506	0	0.017326428	0	0.060216761	0	0.020603444	0	0.110647237	149666.1676	393938.6161	196.969308
	Ellis	0.003279814	44380.67831	0.003307809	0	0.002422289	0	0.005476558	21491.35357	0.001433682	0	0.000472592	0	0.004672353	0	0.016238427	0	0.005556053	0	0.029837824	40359.91215	106231.944	53.11597201
	Johnson	0.000286058	3870.78999	0.000526868	0	0.000211267	0	0.000843297	3309.304764	0.000353404	0	0.000101999	0	0.002742835	0	0.010978701	0	0.000112645	0	0.000512745	693.5603452	7873.655099	3.93682755
	Kaufman	0.006325453	85592.63226	0.006379446	0	0.004671629	0	0.010562096	41448.25165	0.002765	0	0.000911441	0	0.009011105	0	0.031317452	0	0.010715411	0	0.057545265	77838.17756	204879.0615	102.4395307
	Parker	0.000217489	2942.95106	0.000400576	0	0.000160626	0	0.000641157	2516.055375	0.000268692	0	7.75498E-05	0	0.00208537	0	0.008347076	0	8.56434E-05	0	0.000389838	527.3120366	5986.318472	2.993159236
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000819895	11094.37864	0.000826893	0	0.000605529	0	0.001369042	5372.455381	0.000358395	0	0.00011814	0	0.001168005	0	0.004059317	0	0.001388914	0	0.007458924	10089.25876	26556.09278	13.27804639
	Hood	0.01252711	169510.1352	0.012634039	0	0.009251829	0	0.020917482	82085.32156	0.005475887	0	0.001805044	0	0.017845854	0	0.062021991	0	0.021221112	0	0.113964315	154152.9879	405748.4447	202.8742223
	Hunt	0.006187558	83726.72244	0.006240374	0	0.004569788	0	0.010331844	40544.68439	0.002704724	0	0.000891572	0	0.008814664	0	0.030634735	0	0.010481817	0	0.056290785	76141.31399	200412.7208	100.2063604
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.033413751	452136.9648	0.051775843	0	0.024677545	0	0.090663423	355785.4698	0.001141841	0	1.143571754	0	0.046873844	0	0.004669544	0	0.000519582	0	0.002503865	3386.83473	811309.2693	405.6546347
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002000467	27069.24925	0.076378745	0	0.001477434	0	0.133848731	525255.1884	0.001237133	0	0.003554796	0	0.001061766	0	0.001855699	0	0.000401718	0	0.001835165	2482.322128	554806.7598	277.4033799
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.004502334	60923.16724	0.171901148	0	0.003325174	0	0.301245466	1182160.96	0.002784342	0	0.008000571	0	0.002389654	0	0.004176513	0	0.000904124	0	0.004130298	5586.816418	1248670.944	624.335472
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002458599	33268.44554	0.093870431	0	0.001815785	0	0.164501762	645545.1893	0.001520452	0	0.004368889	0	0.001304924	0	0.002280677	0	0.000493717	0	0.00225544	3050.80491	681864.4398	340.9322199
	Travis	0.000510007	6901.141462	0.299602906	0	0.000376663	0	0.033939476	133186.8138	0.000334709	0	0.000906121	0	0.000271138	0	0.000471744	0	0.000103327	0	0.000467336	632.1382746	140720.0936	70.36004678
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.000685965	9282.108461	0.00069182	0	0.000506616	0	0.001145408	4494.863134	0.000299851	0	9.88414E-05	0	0.000977211	0	0.003396227	0	0.001162035	0	0.006240507	8441.175221	22218.14682	11.10907341
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	3079338.049	0.004556851	0	0.168069652	0	0.007612767	29874.36193	0.001680888	0	0.001626796	0	0.046792036	0	0.007246366	0	0.001609426	0	0.008283395	11204.47263	3120416.883	1560.208442
	San Patricio	0.050313351	680813.2952	0.001007478	0	0.037158653	0	0.001683113	6604.946408	0.000371629	0	0.00035967	0	0.010345288	0	0.001602105	0	0.000355829	0	0.001831382	2477.205754	689895.4473	344.9477237
Victoria Area	Victoria	0.021836736	295483	0.002215582	0	0.016127403	0	0.003612695	14177.10069	0.001199621	0	0.000555389	0	0.52545648	0	0.032412721	0	0.000476855	0	0.002254849	3050.005056	312710.1058	156.3550529
Other ERCOT counties	Andrews	2.47421E-05	334.7965969	2.49533E-05	0	1.82731E-05	0	4.13138E-05	162.1253282	1.08153E-05	0	3.56511E-06	0	3.5247E-05	0	0.000122499	0	4.19135E-05	0	0.000225089	304.4649553	801.3868805	0.40069344
	Angelina	0.00031082	4205.848515	0.000313473	0	0.000229554	0	0.000519	2036.6831	0.000135867	0	4.47864E-05	0	0.000442787	0	0.001538876	0	0.000526534	0	0.002827658	3824.810323	10067.34194	5.033670969
	Bosque	0.000595392	8056.522244	0.001096604	0	0.000439723	0	0.001755208	6887.867208	0.000735562	0	0.000212298	0	0.005708837	0	0.02285067	0	0.000234455	0	0.001067208	1443.55141	16387.94086	8.193970431
	Brazos	0.001939725	26247.32152	0.003572622	0	0.001432574	0	0.005718288	22439.96352	0.002396384	0	0.000691644	0	0.018598805	0	0.074445136	0	0.000763829	0	0.003476855	4702.942145	53390.22719	26.69511359
	Calhoun	0.082699809	1119049.473	0.001655986	0	0.061077496	0	0.002766524	10856.51801	0.000610844	0	0.000591187	0	0.0170045	0	0.002633372	0	0.000584875	0	0.003010234	4071.770945	1133977.762	566.9888811
	Cameron	0.048371747	654540.5466	0.000968599	0	0.297964476	0	0.001618161	6350.05994	0.000357288	0	0.00034579	0	0.009946061	0	0.001540279	0	0.000342098	0	0.001760709	2381.60979	663272.2164	331.6361082
	Cherokee	0.003503899	47412.8814	0.003533808	0	0.002587786	0	0.00585073	22959.69861	0.001531635	0	0.00050488	0	0.00499158	0	0.017347879	0	0.005935657	0	0.031876422	43117.40606	113489.9861	56.74499303
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001298787	17574.48774	2.6007E-05	0	0.000959212	0	4.34478E-05	170.499828	9.59321E-06	0	9.2845E-06	0	0.000267053	0	4.13567E-05	0	9.18536E-06	0	4.72752E-05	63.94649234	17808.93406	8.904467032
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003535748	47843.8414	0.003565928	0	0.002611307	0	0.005903911	23168.39108	0.001545556	0	0.00050947	0	0.005036951	0	0.017505563	0	0.00598961	0	0.032166163	43509.32228	114521.5548	57.26077738
	Fannin	0.007056315	95482.26746	0.007116546	0	0.005211403	0	0.011782473	46237.30975	0.003084477	0	0.001016752	0	0.010052276	0	0.034935966	0	0.011953503	0	0.064194222	86831.83929	228551.4165	114.2757082
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003677178	49757.59505	0.003708565	0	0.00271576	0	0.006140067	24095.12673	0.001607379	0	0.000529848	0	0.005238429	0	0.018205785	0	0.006229194	0	0.033452809	45249.69517	119102.4169	59.55120847
	Frio	0.008588335	116212.7401	0.000871383	0	0.006342868	0	0.001420864	5575.818975	0.000471808	0	0.000218433	0	0.206660746	0	0.012747844	0	0.000187546	0	0.000886827	1199.559518	122988.1186	61.49405931
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.188527456	2551052.459	0.003775086	0	0.139235931	0	0.006306735	24749.17117	0.001392518	0	0.001347706	0	0.03876448	0	0.006003193	0	0.001333316	0	0.006862311	9282.253851	2585083.884	1292.541942
	Howard	0.000555113	7511.492147	0.000559851	0	0.000409976	0	0.000926915	3637.441781	0.000242653	0	7.99868E-05	0	0.000790802	0	0.002748377	0	0.00094037	0	0.005050094	6830.971826	17979.90575	8.989952877
	Jack	0.002121449	28706.30484	0.002139557	0	0.001566784	0	0.003542346	13901.03465	0.000927334	0	0.000305682	0	0.00302217	0	0.010503338	0	0.003593766	0	0.019299698	26105.59337	68712.93285	34.35646643
	Jones	0.040718722	550983.9182	0.000815354	0	0.030072592	0	0.001362147	5345.399799	0.00030076	0	0.000291082	0	0.008372468	0	0.001296587	0	0.000287974	0	0.001482142	2004.80887	558334.1268	279.1670634
	Lamar	0.000950838	12866.22795	0.000958954	0	0.000702236	0	0.001587687	6230.473814	0.000415633	0	0.000137007	0	0.001354543	0	0.004707619	0	0.001610734	0	0.008650166	11700.58344	30797.28521	15.3986426
	Limestone	0.000719757	9739.362904	0.000891528	0	0.000531572	0	0.000300183	1177.992011	0.00545518	0	0.001239347	0	0.000497945	0	0.00031596	0	0.000380962	0	0.000523179	707.6743021	11625.02922	5.812514608
	Llano	0.001238174	16754.30612	0.047274044	0	0.000914447	0	0.082844655	325102.7074	0.000765714	0	0.002200214	0	0.000657172	0	0.001148571	0	0.000248641	0	0.001135861	1536.414418	343393.428	171.696714
	McLennan	0.024534317	331985.2276	0.024743738	0	0.018119687	0	0.040966843	160763.922	0.010724513	0	0.003535175	0	0.034951066	0	0.121469933	0	0.041561501	0	0.22319886	301908.2883	794657.4378	397.3287189
	Milam	0.002245405	30383.61549	0.002264571	0	0.001658332	0	0.003749326	14713.27272	0.000981518	0	0.000323543	0	0.003198756	0	0.011117048	0	0.00380375	0	0.02042738	27630.94434	72727.83255	36.36391628
	Mitchell	0.014943169	202202.9478	0.015070721	0	0.011036196	0	0.024951762	97916.82348	0.006532002	0	0.002153177	0	0.02128772	0	0.07398395	0	0.025313952	0	0.135944204	183883.9225	484003.6937	242.0018469
	Nolan	0.000564654	7640.591184	0.000569473	0	0.000417022	0	0.000942846	3699.95802	0.000246823	0	8.13615E-05	0	0.000804394	0	0.002795613	0	0.000956532	0	0.005136889	6948.374849	18288.92405	9.144462027
	Palo Pinto	0.003206998	43395.38221	0.005906709	0	0.002368511	0	0.009454195	37100.57777	0.003962005	0	0.001143513	0	0.030749889	0	0.123082087	0	0.001262858	0	0.005748375	7775.49708	88271.45706	44.13572853
	Pecos	4.09677E-05	554.3526671	4.13174E-05	0	3.02565E-05	0	6.84069E-05	268.4454052	1.79079E-05	0	5.90308E-06	0	5.83617E-05	0	0.000202832	0	6.93999E-05	0	0.0003727	504.1298555	1326.927928	0.663463964
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.000737708	9982.265531	0.000835096	0	0.00054483	0	0.000735917	2887.918708	0.003149678	0	0.000730875	0	0.00076086	0	0.001866305	0	0.191632518	0	0.003397737	4595.924388	17466.10863	8.733054313
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.005696437	77081.13652	0.005745061	0	0.004207073	0	0.009511781	37326.5579	0.002490043	0	0.000820806	0	0.008115023	0	0.028203184	0	0.00964985	0	0.051822854	70097.79969	184505.4941	92.25274705
	Tom Green	0.001482448	20059.69226	2.96846E-05	0	0.001094854	0	4.95918E-05	194.6101718	1.09498E-05	0	1.05974E-05	0	0.000304817	0	4.72049E-05	0	1.04843E-05	0	5.39604E-05	72.98915201	20327.29158	10.16364579
	Upton	3.11661E-05	421.7233203	3.14322E-05	0	2.30176E-05	0	5.20405E-05	204.2196138	1.36234E-05	0	4.49076E-06	0	4.43986E-05	0	0.000154304	0	5.27959E-05	0	0.000283531	383.516359	1009.459293	0.504729647
	Ward	0.018559529	251137.5909	0.01871795	0	0.013707039	0	0.030990277	121613.4355	0.008112796	0	0.002674262	0	0.026439509	0	0.091888626	0	0.03144012	0	0.16884373	228385.2228	601136.2493	300.5681246
	Webb	0.020014327	270823.146	0.000400768	0	0.014781473	0	0.000669531	2627.405161	0.000147832	0	0.000143074	0	0.004115289	0	0.000637307	0	0.000141547	0	0.000728512	985.4165017	274435.9676	137.2179838
	Wharton	0.00014434	1953.127397	0.000178787	0	0.000106601	0	6.01986E-05	236.2339809	0.001093979	0	0.000248538	0	9.98576E-05	0	6.33625E-05	0	7.6398E-05	0	0.000104918	141.916682	2331.27806	1.16563903
	Wichita	0.000207633	2809.58128	0.000209406	0	0.000153346	0	0.000346701	1360.540374	9.07612E-05	0	2.99181E-05	0	0.00029579	0	0.001027996	0	0.000351734	0	0.001888925	2555.041021	6725.162675	3.362581338
	Wilbarger	0.028616818	387227.4402	0.000573025	0	0.021134796	0	0.000957307	3756.707615	0.000211372	0	0.00020457	0	0.005884109	0	0.000911232	0	0.000202386	0	0.001041639	1408.96491	392393.1127	196.1965563
	Wise	0.002844488	38490.08053	0.002882008	0	0.002100781	0	0.00476997	18718.53195	0.001256075	0	0.000413241	0	0.004181914	0	0.014614274	0	0.004797945	0	0.025761411	34845.98242	92054.5949	46.02729745
	Young	0.006235856	84380.26451	0.006289085	0	0.004605458	0	0.010412491	40861.16229	0.002725836	0	0.000898531	0	0.008883468	0	0.030873859	0	0.010563634	0	0.056730171	76735.64696	201977.0738	100.9885369
	Total	**1.121837219**	**15180099.81**	**1.172570094**	**0**	**1.090766584**	**0**	**1.189130767**	**4666440.26**	**1.629360006**	**0**	**1.542362643**	**0**	**1.359385821**	**0**	**1.231642808**	**0**	**1.221806085**	**0**	**1.528786947**	**2067902.361**	**21914442.43**	**10957.22122**
Energy Savings by PCA (MWh)		13531463.88		0		0		3924244.827		0		0		0		0		0		1352642.606			

Table 5-5: OSD NOx Reductions using the 1999 Base Year and the 2007 eGrid (25%)

Area	County	American Electric Power West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.00957217	290.6184546	0.011806715	0	0.007069474	0	0.004263638	34.9614775	0.071001767	0	0.016140391	0	0.006781035	0	0.005179719	0	0.126288049	0	0.008771659	24.93561527	350.5155473	0.175257774
	Chambers	0.021881395	664.3360525	0.027103415	0	0.016160386	0	0.009125896	74.8315916	0.165843463	0	0.037677498	0	0.01513807	0	0.009605529	0	0.011581666	0	0.015905217	45.21452562	784.3821698	0.392191085
	Fort Bend	0.055695513	1690.958739	0.068987309	0	0.041133619	0	0.023228475	190.4715743	0.422127404	0	0.095901908	0	0.038531479	0	0.024449302	0	0.029479235	0	0.040484129	115.0861781	1996.516492	0.998258246
	Galveston	0.027555985	836.6209755	0.033893644	0	0.020351324	0	0.012791501	104.8892547	0.201446635	0	0.045812515	0	0.019823685	0	0.01677514	0	0.594656509	0	0.028709453	81.61373953	1023.12397	0.511561985
	Harris	0.077360573	2348.726696	0.09582276	0	0.057134232	0	0.032264145	264.5633279	0.586331222	0	0.1332069	0	0.053519883	0	0.033959864	0	0.040946397	0	0.056232096	159.8536809	2773.143705	1.386571852
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.001763649	53.54574139	0.003151138	0	0.001302533	0	0.005050143	41.41075359	0.002085751	0	0.00060408	0	0.015958397	0	0.063788818	0	0.000846136	0	0.004013208	11.40853788	106.3650329	0.053182516
	Dallas	0.005045553	153.1868796	0.005305276	0	0.003726366	0	0.008757286	71.80902522	0.002413087	0	0.000782263	0	0.009310387	0	0.033672029	0	0.008209179	0	0.044002183	125.0871203	350.0830251	0.175041513
	Denton	0.000635758	19.30209795	0.001170951	0	0.000469535	0	0.001874207	15.36834264	0.000785431	0	0.000226691	0	0.006095882	0	0.024399888	0	0.00025035	0	0.001139562	3.239488484	37.90992908	0.018954965
	Tarrant	0.015572243	472.7853223	0.015705165	0	0.011500796	0	0.026002176	213.2157013	0.006806985	0	0.002243821	0	0.022183886	0	0.077098512	0	0.026379614	0	0.141667156	402.7240284	1088.725052	0.544362526
	Ellis	0.003502824	106.3484282	0.003532723	0	0.002586991	0	0.005848935	47.96078398	0.001531165	0	0.000504725	0	0.004990048	0	0.017342555	0	0.005933836	0	0.031866639	90.58882629	244.8980385	0.122449019
	Johnson	0.000337176	10.23692454	0.000621017	0	0.00024902	0	0.000993991	8.150645815	0.000416556	0	0.000120226	0	0.003232969	0	0.012940552	0	0.000132774	0	0.00060437	1.718072265	20.10564262	0.010052821
	Kaufman	0.006492753	197.1249774	0.006548174	0	0.004795187	0	0.01084145	88.89899563	0.002838131	0	0.000935547	0	0.009249437	0	0.032145758	0	0.01099882	0	0.059067263	167.9133451	453.9373181	0.226968659
	Parker	0.000475952	14.45025785	0.000876616	0	0.000351511	0	0.0014031	11.50530448	0.000588002	0	0.000169709	0	0.0045636	0	0.01826665	0	0.000187421	0	0.000853118	2.42519979	28.38076212	0.014190381
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000950271	28.85096241	0.000958382	0	0.000701818	0	0.001586741	13.01114458	0.000415385	0	0.000136926	0	0.001353736	0	0.004704812	0	0.001609773	0	0.00864501	24.57558486	66.43769185	0.033218846
	Hood	0.012327882	374.2840103	0.012433111	0	0.00910469	0	0.020584816	168.7937928	0.0053888	0	0.001776337	0	0.017562038	0	0.061035609	0	0.020883617	0	0.112151856	318.8194668	861.8972699	0.430948635
	Hunt	0.006351211	192.8276749	0.006405424	0	0.004690653	0	0.010605108	86.96100746	0.00277626	0	0.000915153	0	0.0090478	0	0.031444984	0	0.010759047	0	0.057779603	164.252853	444.0415354	0.222020768
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.031128114	945.0735556	0.048234164	0	0.0229895	0	0.084461674	692.5787603	0.001063735	0	1.065346769	0	0.043667482	0	0.004350128	0	0.000484041	0	0.002332591	6.63096723	1644.283283	0.822141642
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002007611	60.95260697	0.076651484	0	0.00148271	0	0.134326688	1101.467759	0.00124155	0	0.00356749	0	0.001065557	0	0.001862326	0	0.000403153	0	0.001841718	5.235540137	1167.655907	0.583827953
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.004469515	135.6979121	0.170648096	0	0.003300936	0	0.299049574	2452.181828	0.002764046	0	0.007942252	0	0.002372235	0	0.004146069	0	0.000897533	0	0.00410019	11.6558077	2599.535548	1.299767774
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002469353	74.97145831	0.094281013	0	0.001823727	0	0.165221279	1354.800858	0.001527102	0	0.004387998	0	0.001310631	0	0.002290653	0	0.000495876	0	0.002265306	6.439693045	1436.212009	0.718106005
	Travis	0.000507609	15.41140511	0.298194277	0	0.000374892	0	0.033779905	276.9924304	0.000333135	0	0	0	0.000269863	0	0.000469526	0	0.000102841	0	0.000465139	1.322271612	293.7261071	0.146863054
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.223524525	6786.377084	0.00447587	0	0.165082827	0	0.007477478	61.31470199	0.001651016	0	0.001597886	0	0.045960479	0	0.007117588	0	0.001580824	0	0.008136188	23.12913122	6870.820917	3.435410459
	San Patricio	0.055330886	1679.888402	0.001107949	0	0.040864326	0	0.001850962	15.1777385	0.00040869	0	0.000395538	0	0.01137698	0	0.001761876	0	0.000391315	0	0.002014018	5.725346351	1700.791487	0.850395743
Victoria Area	Victoria	0.020604752	625.5761732	0.002090584	0	0.015217528	0	0.003408874	27.95248915	0.001131941	0	0.000524055	0	0.495811308	0	0.030584062	0	0.000449952	0	0.002127635	6.048330844	659.5769932	0.329788497
Other ERCOT counties	Andrews	2.56527E-05	0.778834648	2.58716E-05	0	1.89456E-05	0	4.28342E-05	0.351237164	1.12134E-05	0	3.69632E-06	0	3.65442E-05	0	0.000127007	0	4.3456E-05	0	0.000233373	0.663420399	1.793492211	0.000896746
	Angelina	0.00032149	9.760689518	0.000324234	0	0.000237435	0	0.000536817	4.401854632	0.000140531	0	4.63239E-05	0	0.000457988	0	0.001591705	0	0.000544609	0	0.002924729	8.314268691	22.47681284	0.011238406
	Bosque	0.000939453	28.52250844	0.001730301	0	0.000693828	0	0.002769496	22.70963933	0.001160623	0	0.000334979	0	0.009007821	0	0.036055459	0	0.000369939	0	0.001683919	4.786958282	56.01910605	0.028009553
	Brazos	0.001913926	58.10828089	0.003525105	0	0.00141352	0	0.005642234	46.26585014	0.002364512	0	0.000682445	0	0.018351436	0	0.073454996	0	0.00075367	0	0.003430612	9.752365121	114.1264962	0.057063248
	Calhoun	0.088525246	2687.694785	0.001772635	0	0.065379841	0	0.0029614	24.28323724	0.000653873	0	0.000632831	0	0.01820231	0	0.002818869	0	0.000626074	0	0.003222277	9.160122488	2721.138144	1.360569072
	Cameron	0.054672288	1659.892841	0.001094762	0	0.285623104	0	0.001828931	14.99707924	0.000403825	0	0.00039083	0	0.011241561	0	0.001740904	0	0.000386657	0	0.001990046	5.657198067	1680.547118	0.840273559
	Cherokee	0.003512995	106.6572433	0.003542982	0	0.002594504	0	0.005865919	48.10005275	0.001535611	0	0.000506191	0	0.005004538	0	0.017392915	0	0.005951066	0	0.031959174	90.85187859	245.6091747	0.122804587
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001355099	41.14186191	2.71346E-05	0	0.001000801	0	4.53316E-05	0.371715419	1.00092E-05	0	9.68705E-06	0	0.000278632	0	4.31498E-05	0	9.58362E-06	0	4.9325E-05	0.140218486	41.65379582	0.020826898
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003629264	110.1872428	0.003660242	0	0.002680373	0	0.006060061	49.69200426	0.001586434	0	0.000522944	0	0.005170172	0	0.017968562	0	0.006148027	0	0.033016916	93.85877313	253.7380202	0.12686901
	Fannin	0.007628516	231.6076382	0.007693632	0	0.005633999	0	0.012737922	104.4499114	0.003334599	0	0.001099201	0	0.010867422	0	0.037768948	0	0.012922821	0	0.069399776	197.2860761	533.3436256	0.266671813
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003774434	114.5947325	0.003806652	0	0.002787588	0	0.006302464	51.67968443	0.001649892	0	0.000543862	0	0.005376978	0	0.018687305	0	0.006393948	0	0.034337593	97.61312405	263.887541	0.131943771
	Frio	0.014763838	448.2415219	0.001497957	0	0.010903753	0	0.002442547	20.02868206	0.000811065	0	0.000375499	0	0.355261637	0	0.021914272	0	0.000322402	0	0.001524506	4.333785619	472.6039896	0.236301995
	Grimes	0.000554424	16.8327472	0.001021149	0	0.000409467	0	0.001634436	13.40224401	0.000684949	0	0.00019769	0	0.005316025	0	0.021278368	0	0.000218322	0	0.000993776	2.825055124	33.06004634	0.016530023
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.239736996	7278.600191	0.004800509	0	0.177056459	0	0.008019827	65.76192217	0.001770766	0	0.001713782	0	0.049294041	0	0.007633834	0	0.001695483	0	0.008726314	24.80671156	7369.168825	3.684584412
	Howard	0.000585081	17.76350659	0.000590075	0	0.000432108	0	0.000976955	8.010947751	0.000255752	0	8.43049E-05	0	0.000833494	0	0.002896748	0	0.000991136	0	0.005322723	15.13116121	40.90561555	0.020452808
	Jack	0.002177558	66.11234569	0.002196145	0	0.001608224	0	0.003636037	29.81520256	0.000951861	0	0.000313767	0	0.003102103	0	0.010781137	0	0.003688816	0	0.01981015	56.31526388	152.2428121	0.076121406
	Jones	0.042500124	1290.336553	0.000851025	0	0.031388236	0	0.00142174	11.65814988	0.000313918	0	0.000303816	0	0.008738755	0	0.001353312	0	0.000300572	0	0.001546985	4.397687171	1306.39239	0.653196195
	Lamar	0.00107998	32.78904035	0.001089199	0	0.000797614	0	0.001803327	14.78713045	0.000472084	0	0.000155616	0	0.001538517	0	0.005347007	0	0.001829503	0	0.00982503	27.93008538	75.50625617	0.037753128
	Limestone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Llano	0.00124346	37.75240233	0.047475864	0	0.000918351	0	0.083198331	682.2194501	0.000768983	0	0.002209607	0	0.000659977	0	0.001153474	0	0.000249702	0	0.00114071	3.242752485	723.2146049	0.361607302
	McLennan	0.023031368	699.2501189	0.023227961	0	0.017009692	0	0.038457253	315.3463051	0.01006754	0	0.003318614	0	0.032809997	0	0.114028801	0	0.039015483	0	0.209525912	595.6293723	1610.225796	0.805112898
	Milam	0.001652492	50.17093536	0.001666598	0	0.001220439	0	0.002759294	22.62597984	0.000722342	0	0.000238109	0	0.002354105	0	0.008181524	0	0.002799346	0	0.015033406	42.73618542	115.5331006	0.05776655
	Mitchell	0.016961453	514.9628026	0.017106233	0	0.012526789	0	0.028321847	232.2368101	0.00741424	0	0.002443993	0	0.024162925	0	0.083976519	0	0.028732956	0	0.154305373	438.651296	1185.850909	0.592925454
	Nolan	0.000603273	18.31583052	0.000608422	0	0.000445544	0	0.001007331	8.260033602	0.000263704	0	8.69262E-05	0	0.00085941	0	0.002986817	0	0.001021953	0	0.005488224	15.60163715	42.17750127	0.021088751
	Palo Pinto	0.003074879	93.35570891	0.00566337	0	0.002270935	0	0.00906471	74.32987471	0.003798781	0	0.001096403	0	0.029483083	0	0.118011463	0	0.001210832	0	0.005511559	15.66797271	183.3535563	0.091676778
	Pecos	4.22618E-05	1.283100302	4.26225E-05	0	3.12122E-05	0	7.05678E-05	0.578649797	1.84736E-05	0	6.08954E-06	0	6.02052E-05	0	0.000209239	0	7.15921E-05	0	0.000384473	1.092959739	2.954709839	0.001477355
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.000359257	10.90733441	0.000406685	0	0.000265328	0	0.000358385	2.93873103	0.001533867	0	0.00035593	0	0.000370532	0	0.000908875	0	0.09332343	0	0.00165467	4.703808861	18.5498743	0.009274937
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tom Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upton	3.2238E-05	0.978769049	3.25131E-05	0	2.38092E-05	0	5.38302E-05	0.441403147	1.40919E-05	0	4.6452E-06	0	4.59255E-05	0	0.000159611	0	5.46116E-05	0	0.000293282	0.833726843	2.253899039	0.00112695
	Ward	0.019807626	601.3748009	0.0199767	0	0.014628815	0	0.033074321	271.206706	0.008658368	0	0.002854101	0	0.028217522	0	0.098067981	0	0.033554415	0	0.180198187	512.2580397	1384.839547	0.692419773
	Webb	0.014180046	430.517128	0.000283942	0	0.010472596	0	0.000474359	3.889708615	0.000104738	0	0.000101367	0	0.002915661	0	0.000451529	0	0.000100285	0	0.000516147	1.467275841	435.8741125	0.217937056
	Wharton	0.00015439	4.687399109	0.000191235	0	0.000114024	0	6.43902E-05	0.52799413	0.001170153	0	0.000265844	0	0.000106811	0	6.77744E-05	0	8.17175E-05	0	0.000112223	0.31902307	5.534416309	0.002767208
	Wichita	0.000219843	6.674601437	0.000221719	0	0.000162364	0	0.000367089	3.010097309	9.60984E-05	0	3.16774E-05	0	0.000313184	0	0.001088447	0	0.000372417	0	0.002000002	5.685503022	15.37020177	0.007685101
	Wilbarger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wise	0.002918471	88.60702923	0.002955932	0	0.002155421	0	0.004892446	40.11765419	0.001287753	0	0.000423725	0	0.004280539	0	0.014952843	0	0.004924352	0	0.026440527	75.16375666	203.8884401	0.10194422
	Young	0.00549666	166.8828449	0.005543579	0	0.004059529	0	0.009178198	75.26046418	0.002402716	0	0.000792019	0	0.007830425	0	0.027214083	0	0.009311425	0	0.050005398	142.1527454	384.2960545	0.192148027
	Total	**1.143037355**	**34703.49616**	**1.154658244**	**0**	**1.089429227**	**0**	**1.180868675**	**9683.025696**	**1.539350626**	**0**	**1.443063194**	**0**	**1.48172714**	**0**	**1.269705424**	**0**	**1.151968562**	**0**	**1.517782624**	**4314.673559**	**48701.19542**	**24.35059771**
Energy Savings by PCA (MWh)		30360.77169		0		0		8199.917488		0		0		0		0		0		2842.748027			

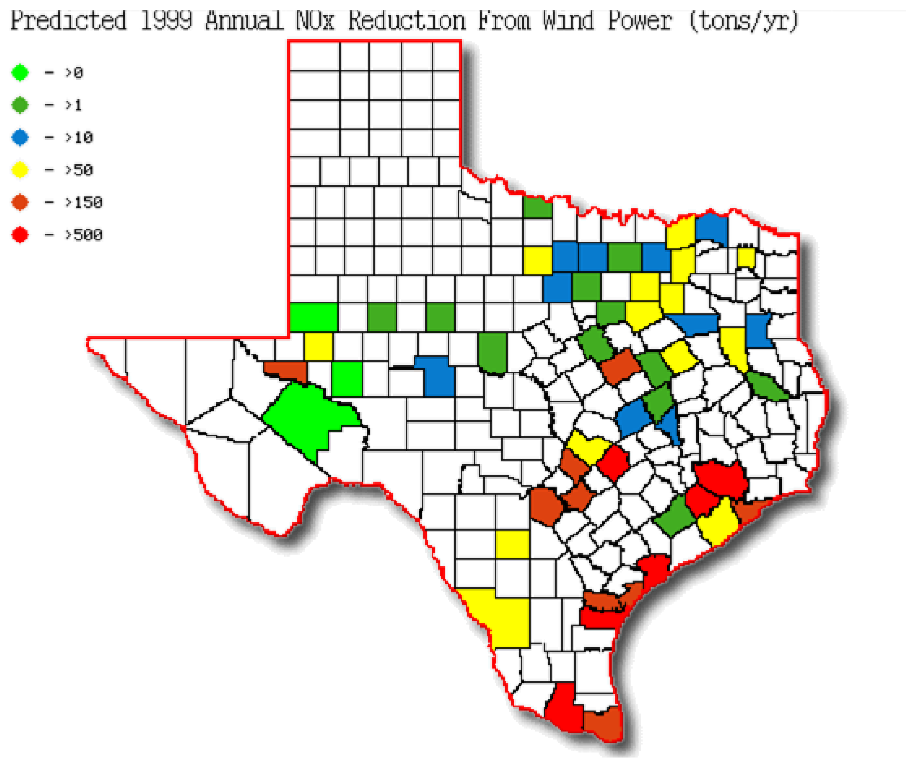


Figure 5-4: 1999 Predicted Annual NOx Reductions from Wind Power in Texas Map

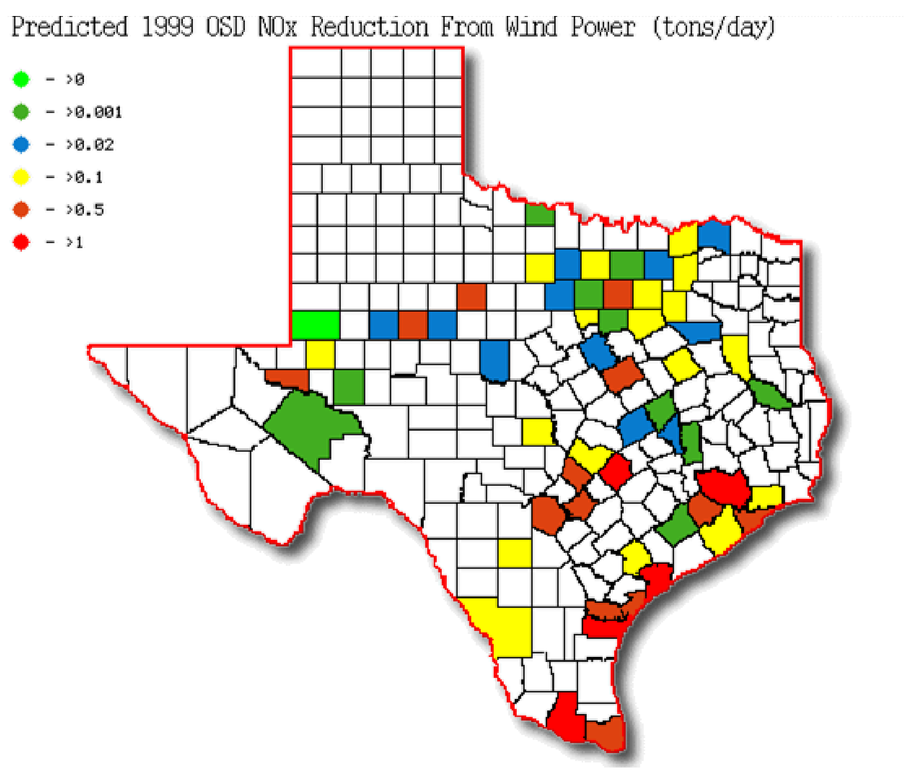


Figure 5-5: 1999 Predicted OSD NOx Reductions from Wind Power in Texas Map

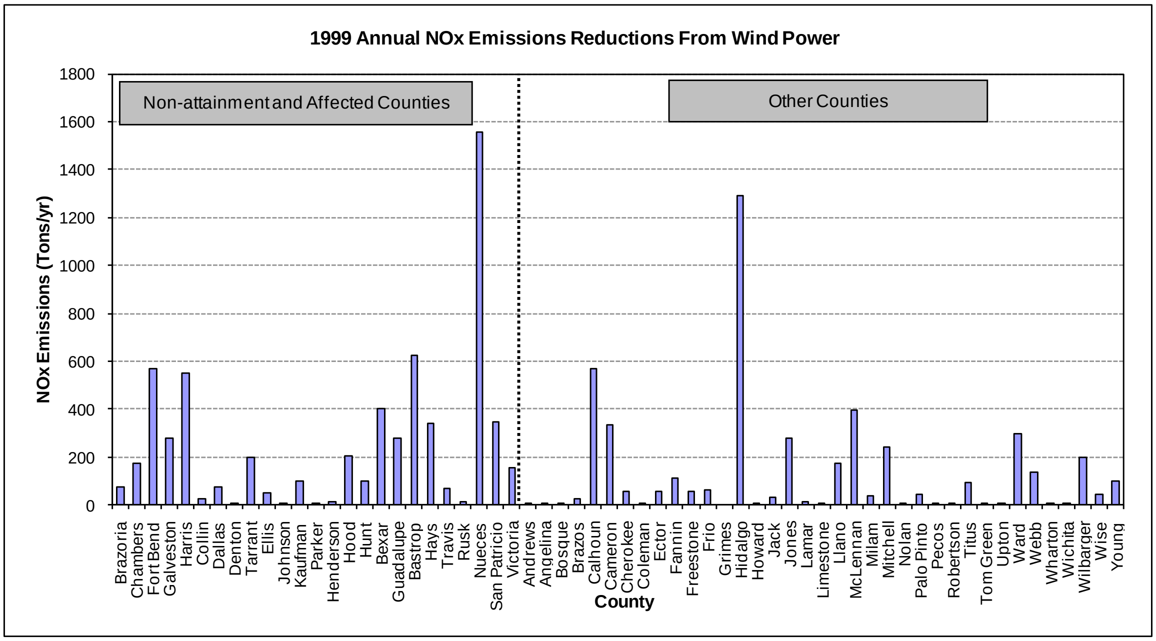


Figure 5-6: 1999 Predicted Annual NOx Reductions from Wind Power

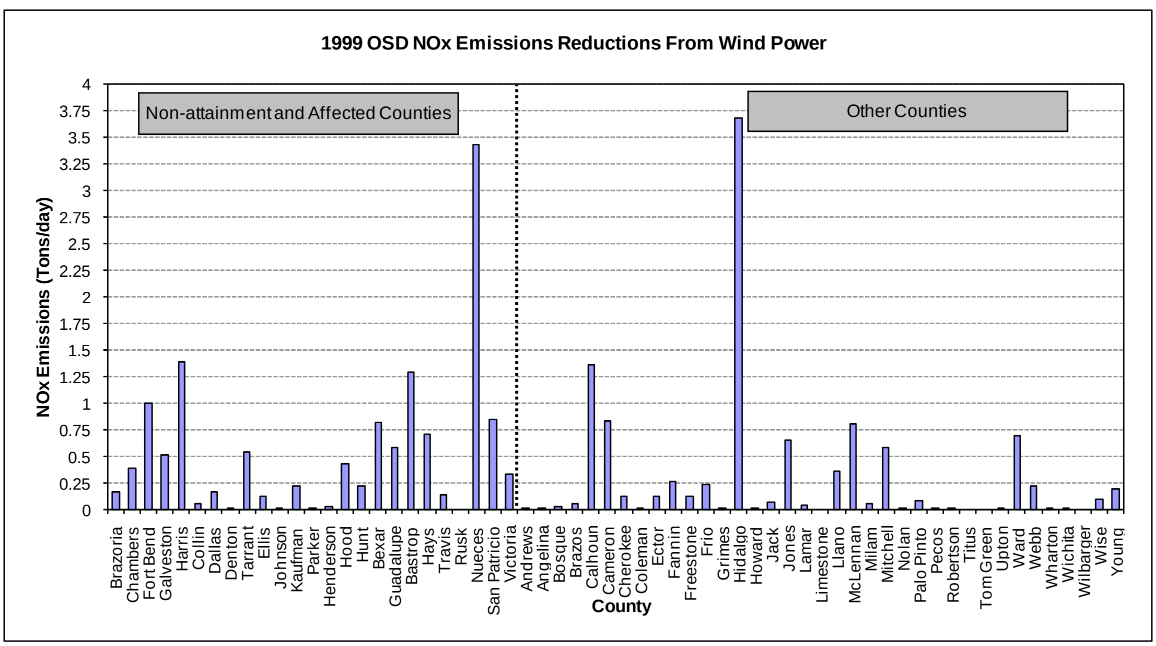


Figure 5-7: 1999 Predicted OSD NOx Reductions from Wind Power

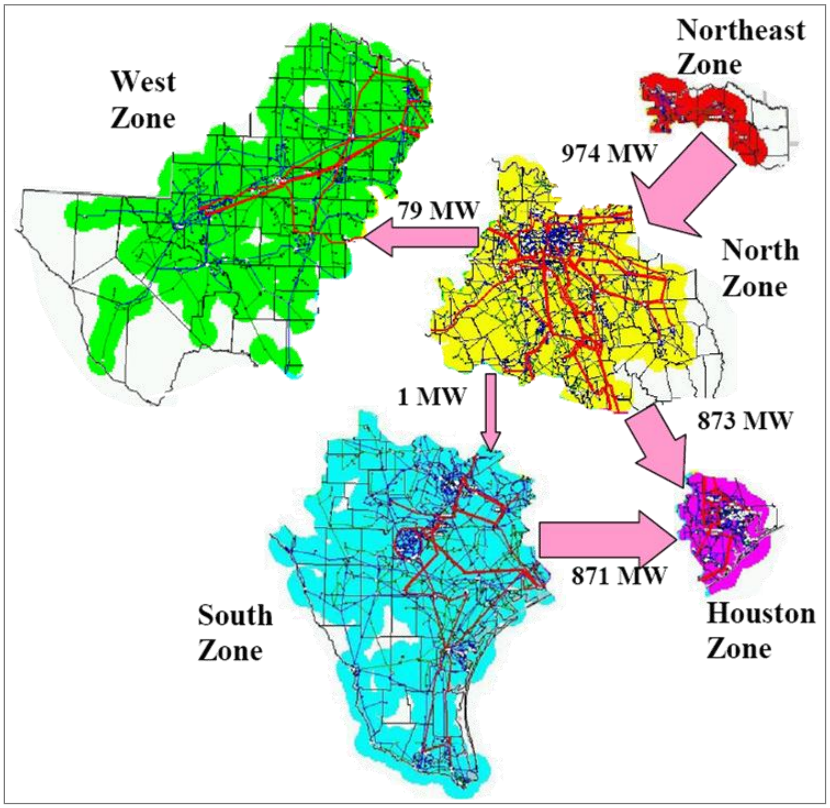


Figure 5-8: Average Modeled Flows on Commercially Significant Constrains for 2006

Table 5-6: Distribution of the Emission Reductions per CM Zone for each County (Year 2010)

County	CM Zones H (lb/MWh)*	H lb	N (lb/MWh)*	N lb	W (lb/MWh)*	W lb	S (lb/MWh)*	S lb	Total (lbs)	Total (Tons)
Andrews	0.000004	1.740	0.000023	4.897	0.003900	130.146	0.000000	0.019	136.8028	0.0684
Atascosa	0.000204	94.703	0.000014	2.930	0.000001	0.022	0.001627	130.854	228.5091	0.1143
Bastrop	0.003378	1,570.200	0.000228	48.577	0.000011	0.367	0.026980	2,169.605	3788.7491	1.8944
Bexar	0.013891	6,456.359	0.000937	199.738	0.000045	1.510	0.110936	8,920.999	15578.6051	7.7893
Bosque	0.002220	1,032.054	0.013621	2,904.167	0.000658	21.954	0.000139	11.175	3969.3500	1.9847
Brazoria	0.056203	26,123.269	0.000007	1.520	0.000000	0.011	0.000527	42.342	26167.1433	13.0836
Brazos	0.002409	1,119.647	0.011231	2,394.456	0.000542	18.101	0.004783	384.623	3916.8262	1.9584
Calhoun	0.000947	439.972	0.000064	13.611	0.000003	0.103	0.007560	607.926	1061.6125	0.5308
Cameron	0.006354	2,953.170	0.000429	91.361	0.000021	0.691	0.050742	4,080.508	7125.7301	3.5629
Chambers	0.020450	9,505.171	0.000003	0.553	0.000000	0.004	0.000192	15.407	9521.1349	4.7606
Cherokee	0.002739	1,273.160	0.016803	3,582.633	0.000812	27.083	0.000171	13.786	4896.6619	2.4483
Coke	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Collin	0.001293	601.065	0.007933	1,691.378	0.000383	12.786	0.000081	6.508	2311.7371	1.1559
Dallas	0.002483	1,153.917	0.015230	3,247.086	0.000736	24.546	0.000155	12.495	4438.0449	2.2190
Denton	0.000127	58.873	0.000777	165.667	0.000038	1.252	0.000008	0.637	226.4306	0.1132
Ector	0.001922	893.118	0.000660	140.794	0.091135	3,041.027	0.014653	1,178.311	5253.2503	2.6266
Ellis	0.002992	1,390.679	0.018354	3,913.326	0.000887	29.583	0.000187	15.059	5348.6469	2.6743
Fannin	0.000004	1.885	0.000025	5.304	0.000001	0.040	0.000000	0.020	7.2488	0.0036
Fayette	0.005187	2,410.781	0.010322	2,200.682	0.000499	16.636	0.028399	2,283.760	6911.8595	3.4559
Fort Bend	0.031346	14,569.784	0.000004	0.848	0.000000	0.006	0.000294	23.616	14594.2536	7.2971
Freestone	0.004764	2,214.467	0.029227	6,231.438	0.001412	47.106	0.000298	23.979	8516.9894	4.2585
Frio	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Galveston	0.022662	10,533.291	0.000003	0.613	0.000000	0.005	0.000212	17.073	10550.9817	5.2755
Goliad	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Grimes	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Guadalupe	0.003203	1,488.704	0.000216	46.055	0.000010	0.348	0.025579	2,057.000	3592.1074	1.7961
Harris	0.148691	69,111.694	0.000019	4.022	0.000001	0.030	0.001393	112.021	69227.7678	34.6139
Hays	0.000833	387.239	0.000056	11.980	0.000003	0.091	0.006654	535.062	934.3715	0.4672
Henderson	0.000691	321.073	0.004238	903.489	0.000205	6.830	0.000043	3.477	1234.8689	0.6174
Hidalgo	0.005372	2,496.710	0.000362	77.240	0.000017	0.584	0.042899	3,449.801	6024.3347	3.0122
Hood	0.005077	2,359.836	0.031145	6,640.503	0.001504	50.199	0.000318	25.553	9076.0903	4.5380
Howard	0.000241	112.072	0.000764	162.907	0.128394	4,284.322	0.000949	76.314	4635.6151	2.3178
Hunt	0.008846	4,111.780	0.004707	1,003.501	0.000227	7.586	0.065282	5,249.745	10372.6119	5.1863
Jack	0.003078	1,430.801	0.018884	4,026.229	0.000912	30.436	0.000193	15.493	5502.9592	2.7515
Johnson	0.000726	337.259	0.004451	949.035	0.000215	7.174	0.000045	3.652	1297.1199	0.6486
Kaufman	0.005972	2,775.718	0.036634	7,810.780	0.001769	59.045	0.000374	30.056	10675.5988	5.3378
Lamar	0.004000	1,859.268	0.024539	5,231.919	0.001185	39.551	0.000250	20.133	7150.8695	3.5754
Limestone	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Llano	0.004031	1,873.818	0.000272	57.970	0.000013	0.438	0.032197	2,589.127	4521.3529	2.2607
McLennan	0.005658	2,629.665	0.034707	7,399.793	0.001676	55.939	0.000354	28.475	10113.8712	5.0569
Milam	0.001269	589.649	0.000086	18.242	0.000004	0.138	0.010132	814.740	1422.7685	0.7114
Mitchell	0.000031	14.469	0.000191	40.714	0.032426	1,082.006	0.000002	0.157	1137.3460	0.5687
Nolan	0.000029	13.598	0.000179	38.264	0.030474	1,016.888	0.000002	0.147	1068.8972	0.5344
Nueces	0.012858	5,976.301	0.000867	184.886	0.000042	1.398	0.102687	8,257.684	14420.2686	7.2101
Palo Pinto	0.003613	1,679.295	0.022164	4,725.483	0.001071	35.722	0.000226	18.184	6458.6840	3.2293
Parker	0.000001	0.571	0.000008	1.608	0.000000	0.012	0.000000	0.006	2.1980	0.0011
Pecos	0.000002	0.916	0.000012	2.577	0.002052	68.473	0.000000	0.010	71.9753	0.0360
Reagan	0.000006	2.751	0.000036	7.742	0.006166	205.744	0.000000	0.030	216.2668	0.1081
Robertson	0.003951	1,836.228	0.005575	1,188.745	0.000269	8.986	0.024617	1,979.599	5013.5587	2.5068
Rusk	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
San Patricio	0.001510	701.827	0.000102	21.712	0.000005	0.164	0.012059	969.741	1693.4447	0.8467
Scurry	0.000027	12.461	0.000164	35.064	0.027926	931.838	0.000002	0.135	979.4977	0.4897
Tarrant	0.000474	220.400	0.002909	620.199	0.000141	4.688	0.000030	2.387	847.6746	0.4238
Titus	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Travis	0.005179	2,406.985	0.000349	74.464	0.000017	0.563	0.041358	3,325.824	5807.8359	2.9039
Upton	0.000003	1.182	0.000016	3.327	0.002649	88.408	0.000000	0.013	92.9292	0.0465
Victoria	0.002119	984.984	0.000143	30.472	0.000007	0.230	0.016924	1,360.991	2376.6777	1.1883
Ward	0.000200	92.737	0.001224	260.958	0.207834	6,935.095	0.000012	1.004	7289.7940	3.6449
Webb	0.004202	1,952.964	0.000283	60.418	0.000014	0.457	0.033557	2,698.485	4712.3240	2.3562
Wharton	0.002110	980.503	0.000142	30.333	0.000007	0.229	0.016847	1,354.798	2365.8632	1.1829
Wichita	0.000012	5.631	0.000074	15.845	0.012619	421.077	0.000001	0.061	442.6130	0.2213
Wilbarger	0.017971	8,352.932	0.110243	23,504.881	0.005325	177.685	0.001125	90.447	32125.9453	16.0630
Wise	0.001020	474.180	0.006258	1,334.328	0.000302	10.087	0.000064	5.135	1823.7299	0.9119
Young	0.007105	3,302.593	0.043588	9,293.391	0.002105	70.253	0.000445	35.761	12701.9989	6.3510
Total	**0.441687**	**205,296.100**	**0.481501**	**102,660.654**	**0.568671**	**18,975.696**	**0.684564**	**55,049.947**	**381,982.398**	**190.99120**
Energy Savings (MWh)	437,747.6		200,800.3		31,426.4		75,735.6			

Total Energy Savings (MWh)	745,709.8
% T&D Loss	6.18 %

* (lb/MWh) are pounds of NOx reduced from one megawatt-hour of electricity savings in that CM Zone.
(lb) are mass of projected NOx emissions reductions from multiplying the total energy savings for the CM Zone at the bottom of the chart by the (lb/MWh) factor in the column to the left.

Table 5-7: Distribution of the Emission Reductions per CM Zone for each County (Year 2015)

County	CM Zones H (lb/MWh)*	H lb	N (lb/MWh)*	N lb	W (lb/MWh)*	W lb	S (lb/MWh)*	S lb	Total (lbs)	Total (Tons)
Andrews	0.000004	3.596	0.000023	15.655	0.003900	417.998	0.000000	0.035	437.2851	0.2186
Atascosa	0.000202	194.058	0.000014	9.287	0.000001	0.071	0.001614	242.418	445.8337	0.2229
Bastrop	0.003350	3217.538	0.000226	153.981	0.000011	1.169	0.026753	4019.366	7392.0548	3.6960
Bexar	0.013774	13229.894	0.000929	633.142	0.000045	4.809	0.110002	16526.858	30394.7029	15.1974
Bosque	0.002149	2064.419	0.013185	8986.465	0.000637	68.252	0.000135	20.210	11139.3454	5.5697
Brazoria	0.052595	50518.480	0.001053	717.602	0.000051	5.450	0.000068	10.223	51251.7555	25.6259
Brazos	0.002346	2252.898	0.010872	7409.883	0.000525	56.278	0.004740	712.139	10431.1973	5.2156
Calhoun	0.000939	901.558	0.000063	43.146	0.000003	0.328	0.007496	1126.232	2071.2635	1.0356
Cameron	0.006300	6051.418	0.000425	289.602	0.000021	2.200	0.050315	7559.466	13902.6855	6.9513
Chambers	0.019075	18321.635	0.000002	1.649	0.000000	0.013	0.000179	26.849	18350.1453	9.1751
Cherokee	0.002651	2546.704	0.016265	11085.866	0.000786	84.196	0.000166	24.931	13741.6977	6.8708
Coke	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Collin	0.001252	1202.311	0.007679	5233.689	0.000371	39.750	0.000078	11.770	6487.5200	3.2438
Dallas	0.002403	2308.182	0.014742	10047.574	0.000712	76.311	0.000150	22.596	12454.6625	6.2273
Denton	0.000123	117.764	0.000752	512.631	0.000036	3.893	0.000008	1.153	635.4412	0.3177
Ector	0.001906	1830.818	0.000659	449.376	0.091135	9767.029	0.014529	2182.922	14230.1454	7.1151
Ellis	0.002896	2781.777	0.017766	12109.144	0.000858	91.968	0.000181	27.232	15010.1212	7.5051
Fannin	0.000004	3.770	0.000024	16.411	0.000001	0.125	0.000000	0.037	20.3426	0.0102
Fayette	0.005104	4902.695	0.009997	6813.496	0.000483	51.748	0.028158	4230.482	15998.4210	7.9992
Fort Bend	0.029238	28083.898	0.000004	2.528	0.000000	0.019	0.000274	41.154	28127.6000	14.0638
Freestone	0.004612	4429.600	0.028290	19282.157	0.001366	146.447	0.000289	43.364	23901.5672	11.9508
Frio	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Galveston	0.021138	20303.381	0.000003	1.828	0.000000	0.014	0.000198	29.753	20334.9758	10.1675
Goliad	0.017491	16800.188	0.000002	1.512	0.000000	0.011	0.000164	24.619	16826.3314	8.4132
Grimes	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Guadalupe	0.003176	3050.543	0.000214	145.990	0.000010	1.109	0.025364	3810.755	7008.3963	3.5042
Harris	0.138692	133215.829	0.000018	11.993	0.000001	0.091	0.001299	195.215	133423.1280	66.7116
Hays	0.000826	793.501	0.000056	37.975	0.000003	0.288	0.006598	991.246	1823.0094	0.9115
Henderson	0.000669	642.243	0.004102	2795.699	0.000198	21.233	0.000042	6.287	3465.4619	1.7327
Hidalgo	0.005326	5116.075	0.000359	244.840	0.000017	1.860	0.042538	6391.029	11753.8035	5.8769
Hood	0.004914	4720.382	0.030147	20547.941	0.001456	156.060	0.000308	46.211	25470.5944	12.7353
Howard	0.000240	230.645	0.000764	520.730	0.128394	13760.193	0.000941	141.388	14652.9560	7.3265
Hunt	0.008756	8410.184	0.004569	3114.040	0.000221	23.651	0.064732	9725.418	21273.2926	10.6366
Jack	0.002980	2862.033	0.018279	12458.501	0.000883	94.621	0.000186	28.018	15443.1741	7.7216
Johnson	0.000702	674.619	0.004309	2936.633	0.000208	22.304	0.000044	6.604	3640.1592	1.8201
Kaufman	0.005781	5552.271	0.035460	24169.171	0.001713	183.563	0.000362	54.354	29959.3589	14.9797
Lamar	0.003872	3719.095	0.023753	16189.311	0.001147	122.957	0.000242	36.408	20067.7705	10.0339
Limestone	0.000172	164.730	0.001052	717.073	0.000051	5.446	0.000011	1.613	888.8621	0.4444
Llano	0.003998	3839.690	0.000270	183.756	0.000013	1.396	0.031926	4796.563	8821.4046	4.4107
McLennan	0.009476	9101.765	0.033595	22897.785	0.001623	173.907	0.000380	57.124	32230.5814	16.1153
Milam	0.001258	1208.265	0.000085	57.824	0.000004	0.439	0.010046	1509.371	2775.8985	1.3879
Mitchell	0.000031	29.900	0.000191	130.154	0.032426	3475.139	0.000002	0.293	3635.4857	1.8177
Nolan	0.000029	28.100	0.000179	122.321	0.030474	3265.995	0.000002	0.275	3416.6916	1.7083
Nueces	0.012750	12246.195	0.000860	586.065	0.000042	4.451	0.101823	15298.015	28134.7255	14.0674
Palo Pinto	0.003497	3359.096	0.021453	14622.228	0.001036	111.055	0.000219	32.884	18125.2628	9.0626
Parker	0.000001	1.143	0.000007	4.976	0.000000	0.038	0.000000	0.011	6.1682	0.0031
Pecos	0.000002	1.892	0.000012	8.237	0.002052	219.919	0.000000	0.019	230.0664	0.1150
Reagan	0.000006	5.685	0.000036	24.749	0.006166	660.799	0.000000	0.056	691.2891	0.3456
Robertson	0.003897	3742.805	0.005402	3681.717	0.000261	27.962	0.024409	3667.169	11119.6535	5.5598
Rusk	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
San Patricio	0.001497	1438.132	0.000101	68.825	0.000005	0.523	0.011958	1796.523	3304.0024	1.6520
Scurry	0.000027	25.750	0.000164	112.091	0.027926	2992.837	0.000002	0.252	3130.9295	1.5655
Tarrant	0.000459	440.867	0.002816	1919.105	0.000136	14.575	0.000029	4.316	2378.8630	1.1894
Titus	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.000000	0.000	0.0000	0.0000
Travis	0.005135	4932.217	0.000346	236.041	0.000017	1.793	0.041010	6161.353	11331.4027	5.6657
Upton	0.000003	2.443	0.000016	10.635	0.002649	283.943	0.000000	0.024	297.0448	0.1485
Victoria	0.002101	2018.358	0.000142	96.592	0.000007	0.734	0.016782	2521.343	4637.0270	2.3185
Ward	0.000200	191.642	0.001224	834.220	0.207834	22273.828	0.000012	1.876	23301.5659	11.6508
Webb	0.004166	4001.870	0.000281	191.517	0.000014	1.455	0.033274	4999.158	9193.9994	4.5970
Wharton	0.002092	2009.174	0.000141	96.153	0.000007	0.730	0.016706	2509.871	4615.9274	2.3080
Wichita	0.000012	11.636	0.000074	50.651	0.012619	1352.396	0.000001	0.114	1414.7965	0.7074
Wilbarger	0.017395	16708.378	0.106711	72731.982	0.005154	552.394	0.001089	163.568	90156.3224	45.0782
Wise	0.000987	948.503	0.006058	4128.859	0.000293	31.358	0.000062	9.285	5118.0059	2.5590
Young	0.006878	6606.181	0.042191	28756.867	0.002038	218.406	0.000430	64.672	35646.1265	17.8231
Total	**0.441552**	**424118.419**	**0.468411**	**319259.869**	**0.568038**	**60877.526**	**0.678325**	**101912.488**	**906,168.302**	**453.08415**
Energy Savings (MWh)	904,611.9		641,911.0		100,933.8		141,496.8			

Total Energy Savings (MWh)	1,788,953.5
% T&D Loss	6.18 %

* (lb/MWh) are pounds of NOx reduced from one megawatt-hour of electricity savings in that CM Zone.
(lb) are mass of projected NOx emissions reductions from multiplying the total energy savings for the CM Zone at the bottom of the chart by the (lb/MWh) factor in the column to the left.

6 OTHER RENEWABLE SOURCES

Renewable energy projects throughout the state of Texas were found to determine NOx emissions reduction. Five specific categories were determined to search within solar photovoltaic, solar thermal, geothermal, hydroelectric, and Landfill Gas-Fired Power Plants. The criteria for each project to be included in the data collection were that the installation date was after the year 2000 and the project was installed within the state of Texas. However, projects installed before the year 2000, were also included in order to provide a complete record.

6.1 Implementation

As already specified this is an updated version of the earlier report published in May 2009. It reports a lot of newly located renewable energy projects, in three of the five main categories as already discussed.

The information was collected using the following modes:

- Information from the websites of manufacturers, distributors, consultants related with renewable energy products
- Some information was collected by personally emailing individuals, who were either manufacturers, distributors or consultants
- Information from the internet- websites of environmental agencies like ERCOT, EIA, NREL publish information which is available to the general public

It was partly the same methodology/protocol followed for data collection used in the previous report. Almsot all of the information collected was sourced from websites of manufacturers, distributors, consultants etc. Most of the project descriptions did not include system specifications data. In most cases the information obtained was very limited.

To collect more information we emailed manufacturers, consultants, distributors or officers in environmental agencies. We could not elicit a response from people whom we contacted.

6.2 Renewable Energy Projects

6.2.1 Solar Photovoltaic

Apart from about 232 projects which were reported in the previous report, we were able to locate about 135 new projects. The website of the company "Meridian Solar" reported about 85 new projects. This website provides only the important details like capacity and location. Most of the new projects sourced from this website were residential type small projects. They did not contain system specification data.

Apart from these sources another website of a company, "Solar community" reported about 33 projects installed in the state of Texas with only the important details like capacity and location.

The website of"Soltrex" provided information about two new projects which were not included in the previous report. The website of "Standard Renewable Energy" provides information about 4 new projects.

A summary of the different projects and their outputs of ECALC can be found in Table 6-2. This annual electric savings per county due to these projects are presented in Figure 6-6 and the respective emission reductions are shown in Figure 6-8. The number of projects per county is presented in Figure 6-1.

6.2.2 Solar Thermal

Apart from the projects reported by Techsun Solar and Alternative Power Solutions which were included in the previous report, we were able to locate eleven more projects in this new report. The new projects reported were sourced from the websites of two companies “Cincosolar” and “Sunrise Solar”. Another non-profit agency Solar SanAntonio reported about four new projects.

A summary of the different projects and their outputs of ECALC, can be found in Table 6-4 and Table 6-5, respectively. This annual electric savings per county, due to these projects are presented in Figure 6-10 and the respective emission reductions, are shown in Figure 6-12. The number of projects per county is presented in Figure 6-1.

6.2.3 Hydroelectric

Apart from the forty five projects reported in the previous report no new projects were identified as far as Hydroelectric power plants are concerned. No new hydroelectric projects were installed in the state of Texas after the year 2000.

All hydroelectric projects located and their information is presented in Table 6-7. A Texas map which shows the location of the different projects per county is presented in Figure 6-3.

6.2.4 Geothermal

As far as geothermal heat pumps are concerned, information provided by “Image Engineering Group” a consultant group, listed about 150 different geothermal heat pump projects, installed in the state of Texas in different schools and organizations and were reported in our previous report. They have been listed inTable 6-8.This forms a major chunk of the projects reported to date thanks to Mr. Don Penn, of Image Engineering Group and Dr.Greg Tinkler, consulting engineer, of RLB consulting engineers.

About five new projects were located and included in this report. “FHP manufacturing”, a geothermal heat pump manufacturer, provided information about two new projects, installed in the state of Texas. The website http://geoheat.oit.edu/ lists three projects. This information was also used in this report.

The resulting information can be found in Table 6-8 with a corresponding map in Figure 6-4, which shows the number of projects in different counties.

6.2.5 Landfill Gas-Fired Power Plants

As far as Landfill gas powered power plants are concerned, information provided by the Environmental Protection Agency’s (EPA’s) project database for Landfill Methane Outreach Program (LMOP) formed the main source of information for the previous report.

We were not able to locate any new projects for this report.
The implemented, candidate, and potential projects are listed in Table 6-11 and Table 6-11 respectively.
Figure 6-5 shows the location of these operational projects implemented throughout Texas.

6.3 Results

We were able to considerably increase the number of renewable energy projects identified in the state of Texas to date. Some 140 new projects were identified, located and included in the new report (which did not form a part of the old report published in May 2009). The details of which are as follows:

Table 6-1: New Projects Reported in February 2010

S.No	Renewable Energy Source	No Of New Projects Reported in February 2010
1	Solar Photo-Voltaic	124
2	Solar Thermal	11
3	Land fill gas	0
4	Hydro-Electric	0
5	Geothermal	5

The report also includes the emission reduction calculations included in the previous report

6.4 References

Haberl, J., Culp, C., Yazdani, B., Gilman, D., Fitzpatrick, T., Muns, S., Verdict, Ahmed, M., Liu, Z., Baltazar-Cervantes, J., Degelman, L., Turner, D., "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)." Vol. II-Summary Report, Annual Report to the Texas Commission on Environmental Quality, September 2004-December 2005, Energy Systems Laboratory Report No. ESL-TR-06-06-08.

Useful information was obtained from the following websites:

- http://www.soltrex.com/systems.cfm?state=tx
- http://www.meridiansolar.com/portfolio_commercial/commerical.html
- http://www.sre3.com/projectGallery.jsp
- http://www.sre3.com/index.jsp
- http://apowersolutions.com/pdf/Commercial%20Solar%20Pool%20Heating%20Case%20Studies.pdf
- http://www.eia.doe.gov/cneaf/electricity/page/eia860.html
- http://www.iegltd.com/project.refer.geo.master.pdf
- http://www.iegltd.com/html/information.html
- http://geoheat.oit.edu/state/tx/tx.htm
- http://data.memberclicks.com/site/treia/Maria_RichardsSchools.pdf
- http://www.southwestpv.com/SolarSite/SolarSiteMain.aspx
- http://www.fhp-mfg.com/
- http://www.solarsanantonio.org/localrenewable.html
- http://www.txspc.com/renewable-energy-links.html
- http://www.solarsanantonio.org/localinstallers.html
- http://www.cincosolar.com/history.php
- http://www.solarcommunity.net/examples.htm
- http://www.sunrisesolartx.com/commercial/

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
1	Giddings Middle School	Giddings, TX	Lee	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
2	La Grange Intermediate School	La Grange, TX	Fayette	Bastrop	May-05	GE Energy GEPV-050-M	1	121.4	30	180
3	Schulenburg Elementary School	Schulenburg, TX	Fayette	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
4	Smithville Junior High School	Smithville, TX	Bastrop	Bastrop	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
5	Bastrop Intermediate School	Bastrop, TX	Bastrop	Bastrop	May-07	Sharp Electronics NE-170-U1	1.02	84	35	180
6	Eagle Pass High School - CC Winn Campus	Eagle Pass, TX	Maverick	Bexar	Feb-02	Siemens SP 75	0.9	81.84	25	180
7	East Central ISD	San Antonio, TX	Bexar	Bexar	Nov-03	Shell SP-140-PC	1.12	113.92	60	180
8	James Madison High School	San Antonio, TX	Bexar	Bexar	Feb-02	Siemens SP 75	0.9	81.84	25	180
9	John Jay High School	San Antonio, TX	Bexar	Bexar	Dec-01	Siemens SP 75	0.9	81.84	60	180
10	Roosevelt High School	San Antonio, TX	Bexar	Bexar	Mar-04	Shell SP140PC	1.12	113.92	30	180
11	Utopia ISD	Utopia, TX	Uvalde	Bexar	Jun-05	GE Energy GEPV-050-M	1	121.4	30	180
12	City Public Services of San Antonio, Northsid	San Antonio, TX	Bexar	Bexar	Jul-02	MSX-120	17.28	1699.2	30*	180*
13	Del Rio High School	Del Rio, TX	Kinney	Bexar	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
14	Kendall Elementary School	Boerne, TX	Kendall	Bexar	Apr-07	Sharp Electronics NE-170-U2	1.02	84	35	180
15	Uvalde Junior High School	Uvalde, TX	Uvalde	Bexar	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
16	City Public Services Primary Control Center	San Antonio, TX	Bexar	Bexar	Jun-04	BP MSX-120	17.28	1699.2	30*	N/A
17	Institute of Texan Cultures	San Antonio, TX	Bexar	Bexar	N/A	N/A	15	N/A	N/A	N/A
18	Ft. Sam Houston Bldg. 1350	San Antonio, TX	Bexar	Bexar	Apr-06	N/A	181	N/A	N/A	N/A
19	Bexar County Jail Annex	San Antonio, TX	Bexar	Bexar	N/A	N/A	N/A	N/A	N/A	N/A
20	Alvin High School	Alvin, TX	Brazoria	Brazoria	Nov-03	Shell SP-140-PC	1.12	113.92	30	180
21	El Campo Middle School	El Campo, TX	Wharton	Brazoria	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
22	Bluebonnet Elementary School	Lockhart, TX	Caldwell	Caldwell	Jul-05	GE Energy GEPV-050-M	1	121.4	30	180
23	Flatonia Elementary School	Flatonia, TX	Gonzales	Caldwell	May-07	Sharp Electronics NE-170-U1	1.02	84	35	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
24	Waelder ISD	Waelder, TX	Gonzales	Caldwell	May-07	Sharp Electronics NE-170-U5	1.02	64.08	35	180
25	Blue Ridge ISD	Blue Ridge, TX	Collin	Collin	Oct-03	Siemens SP 75	0.9	81.84	25	180
26	McKinney Green Building	McKinney, TX	Collin	Collin	Mar-06	ASE-300-DG-FT	45	3749.76	30*	N/A
27	Canyon High School	New Braunfels, TX	Comal	Comal	Feb-04	Shell SP140PC	1.12	113.92	20	230
28	Dallas ISD Environmental Education Center	Seagoville, TX	Dallas	Dallas	Feb-04	Shell Solar SP140PC	1.12	113.92	30	180
29	The Winston School	Dallas, TX	Dallas	Dallas	N/A	BP XXXXXXX	71	N/A	0	N/A
30	Childress High School	Childress, TX	Childress	Denton	Jul-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
31	Cordova Middle School	El Paso, TX	El Paso	El Paso	Jan-03	Shell SP140PC	1.12	113.92	25	180
32	Gene Roddenberry Planetarium	El Paso, TX	El Paso	El Paso	Jun-02	4-kW ASE SunSine AC	3.42	313.44	25	180
33	Monahans High School	Monahans, TX	Ward	El Paso	Dec-01	Siemens SP 75	0.9	81.84	60	180
34	Presidio High School	Presidio, TX	Presidio	El Paso	Dec-99	ASE Americas ASE-300-DG/50	4.56	418.08	25	180
35	Weimar High School	Weimar, TX	Colorado	Fort Bend	May-05	GE Energy GEPV-050-M	1	121.4	30	180
36	Univeresity of Texas Medical Branch at Galveston	Galveston, TX	Galveston	Galveston	Mar-02	Solarex SX-80U	19.2	1892.88	30*	180*
37	Pine Tree Junior High School	Longview, TX	Gregg	Gregg	Mar-00	ASE Americas ASE-300-DG/50	4.56	417.92	25	180
38	Marion Middle School	Marion, TX	Guadalupe	Guadalupe	May-05	GE Energy GEPV-050-M	1	121.4	30	180
39	Seabrook Intermediate School	Seabrook, TX	Harris	Harris	Nov-03	Shell SP-140-PC	1.12	113.92	60	180
40	NASA Johnson Space Center	Houston, TX	Harris	Harris	Oct-04	MSX-121	9.72	955.8	30*	180*
41	UT Health Science Center	Houston, TX	Harris	Harris	Feb-00	Solarex SJ-7500	1.5	271	30*	180*
42	Aircraft Obstruction Light	Houston, TX	Harris	Harris	N/A	SX65U	N/A	162.6	30*	180*
43	Learning Center at Sheldon Lake State Park	Houston, TX	Harris	Harris	N/A	BP Solar	170	108.4	40	180*
44	Learning Center at Sheldon Lake State Park	Houston, TX	Harris	Harris	N/A	N/A	N/A	81.3	25	180*
45	Hempstead Middle School	Hempstead, TX	Washington	Harris	Apr-07	Sharp Electronics NE-170-U1	1.02	84	35	180
46	Houston Ship Channel	Houston, TX	Harris	Harris	Sep-00	BP SX65U	0.78	72	30*	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
47	La Grange Intermediate School	La Grange, TX	Fayette	Bastrop	05/01/05	GE Energy GEPV-050-M	1	6.07	30	180
48	Weimar High School	Weimar, TX	Colorado	Fort Bend	5/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
49	Marion Middle School	Marion, TX	Guadalupe	Guadalupe	5/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
50	Giddings Middle School	Giddings, TX	Lee	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
51	Schulenburg Elementary School	Schulenburg, TX	Fayette	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
52	Smithville Junior High School	Smithville, TX	Bastrop	Bastrop	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
53	Utopia ISD	Utopia, TX	Uvalde	Bexar	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
54	Brenham Middle School	Brenham, TX	Washington	Montgomery	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
55	Cuero Junior High School	Cuero, TX	DeWitt	Victoria	6/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
56	Bluebonnet Elementary School	Lockhart, TX	Caldwell	Caldwell	7/5/2008	GE Energy GEPV-050-M	1	121.4	30	180
57	McKinney Green Building	McKinney, TX	Collin	Collin	3/6/2008	ASE-300-DG-FT	45	3749.76	30*	N/A
58	Ft. Sam Houston Bldg. 1350	San Antonio, TX	Bexar	Bexar	4/6/2008	N/A	181	N/A	N/A	N/A
59	Bedichek Middle Shool	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
60	Blanton Elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
61	Cunningham elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
62	Garza High School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
63	Martin Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
64	Murchison Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
65	O'Henry Middle School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
66	Pond Springs Elementary School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
67	Westwood High School	Austin, TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	225
68	Zilker Elementary School	Austin TX	Travis	Travis	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180
69	Davis Elementary School	Round Rock, TX	Williamson	Williamson	10/6/2008	Sharp ND-L3EJEA	4.059	352.44	30	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity (kW)	Total Area (sqft)	Slope	Azimuth (South=180)
70	Bedichek Middle Shool	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
71	Blanton Elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
72	Cunningham elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
73	Garza High School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
74	Harper School	Harper, TX	Gillespie	Travis	Mar-07	Sharp Electronics NE-170-U1	1.02	84	35	180
75	Llano Junior High School	Llano, TX	Llano	Travis	Apr-07	Sharp Electronics NE-170-U5	1.02	84	35	180
76	Martin Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
77	Murchison Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
78	O'Henry Middle School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
79	Pond Springs Elementary School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
80	San Marcos Electric Utility	San Marcos, TX	Travis	Travis	Apr-07	Sharp Electronics NE-170-U5	1.02	64.08	35	180
81	Sonora High School	Sonora, TX	Sutton	Travis	Dec-99	ASE Americas ASE-300-DG/50	4.56	418.08	15	220
82	Vliet Residence	Austin, TX	Travis	Travis	Jan-99	Siemens SP 75	1.8	163.92	20	260
83	Westwood High School	Austin, TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	225
84	Zilker Elementary School	Austin TX	Travis	Travis	Oct-06	Sharp ND-L3EJEA	4.059	352.44	30	180
85	Courtyard Tennis Club	Austin, TX	Travis	Travis	N/A	N/A	23	N/A	N/A	N/A
86	Escarpment Village	Austin, TX	Travis	Travis	N/A	N/A	7	N/A	N/A	N/A
87	IBM	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
88	Hines Pool and Spa	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
89	Centex Beverage Inc.	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
90	Lake Austin Marina	Austin , TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
91	Habitat Suites	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
92	Palmer events Center	Austin, TX	Travis	Travis	N/A	N/A	36	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
93	Hines Pool and Spa	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
94	Centex Beverage Inc.	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
95	Lake Austin Marina	Austin , TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
96	Habitat Suites	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
97	Palmer events Center	Austin, TX	Travis	Travis	N/A	N/A	36	N/A	N/A	N/A
98	LCRA Environmental Laboratory	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
99	Austin Bergstrom International Airport	Austin, TX	Travis	Travis	N/A	N/A	32	N/A	N/A	N/A
100	Sand Hill power Plant, Control Building	Austin, TX	Travis	Travis	N/A	N/A	15	N/A	N/A	N/A
101	Spring Terrace	Austin, TX	Travis	Travis	N/A	N/A	18	N/A	N/A	N/A
102	American YouthWorks	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
103	Town Lake Trail Foundation	Austin, TX	Travis	Travis	N/A	N/A	0.5	N/A	N/A	N/A
104	Garden Terrace	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
105	Vintage Creek learning Center	Austin, TX	Travis	Travis	N/A	N/A	11	N/A	N/A	N/A
106	Ebeneezer Baptist Church	Austin, TX	Travis	Travis	N/A	N/A	8.4	N/A	N/A	N/A
107	Sierra Ridge	Austin, TX	Travis	Travis	N/A	N/A	17	N/A	N/A	N/A
108	Westcave Preserve	Round Mountain, TX	Llano	Travis	N/A	N/A	1.7	N/A	N/A	N/A
109	St. Andrews Episcopal School	Austin, TX	Travis	Travis	N/A	N/A	22	N/A	N/A	N/A
110	St. Gabriel Catholic Church	Austin, TX	Travis	Travis	N/A	N/A	21	N/A	N/A	N/A
111	Hornsby Bend Birding Shelter	Austin, TX	Travis	Travis	N/A	N/A	0.3	N/A	N/A	N/A
112	Casa Verde	Austin, TX	Travis	Travis	N/A	N/A	1.5	N/A	N/A	N/A
113	Solar Powered Water Purification	Matagorda Island, TX	Calhoun	Victoria	N/A	BP585U	N/A	111.23	30*	180*
114	Austin Clint Small middle school	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T130	3.12	N/A	30	180
115	City Hall, Austin, Texas	Austin, TX	Travis	Travis	xxx-04	PROSOL (type-austin)***	9.74	894.3	30*	180*
116	Austin Dessau Elementary	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T130	3.12	N/A	30	180
117	Austin Gus Garcia Middle School	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T131	3.12	N/A	30	180
118	Austin Lake Travis Elementary	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T132	3.12	N/A	30	180

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
119	Austin Lake Travis High School	Austin TX	Travis	Travis	9/12/2008	Kyrocera 6T132	3.12	N/A	30	180
120	Greenville ISD Bowie elementary	Greenville, TX	Hunt		2/9/2009	Sharp NE170	4.08	336	32	180
121	Greenville ISD Carver elementary	Greenville, TX	Hunt		2/9/2009	Sharp NE170	4.08	336	32	180
122	Greenville ISD Crockett elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
123	Greenville ISDLamar elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
124	Greenville ISD Middle Sxhool	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
125	Greenville ISD Travis Elementary	Greenville, TX	Hunt		2/9/2009	sharp SH170	4.08	336	32	180
126	Manor Middle Sxhool	Manor,TX	Travis	Travis	10/24/2007	Sharp NE170	1.02	84	35	180
127	McKinney Roughs Nature Center	Cedar Creek, TX	Henderon		3/24/2008	Sharp NE170	1.02	84	35	180
128	San Saba Middle School	San Saba, TX	San Saba		6/18/2007	Sharp NE170	1.02	84	35	180
	Note: (*) = Assumed									
129	Villas on 6th	Austin, TX	Travis	Travis	N/A	N/A	9.1	N/A	N/A	N/A
130	Installation for a an electronics equipment	Austin, TX	Travis	Travis	N/A	N/A	9.1	N/A	N/A	N/A
131	Solar Decathlon	Austin,TX	Travis	Travis	N/A	N/A	3.7	N/A	N/A	N/A
132	Bracken Cave	Bracken ,TX	Comal		N/A	N/A	0.5	N/A	N/A	N/A
133	Residential project #163 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
134	Residential project #157 by Meridian Energy	Plano, TX	Collin	Collin	N/A	N/A	2	N/A	N/A	N/A
135	Residential project #126 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.9	N/A	N/A	N/A
136	Residential project #224 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.75	N/A	30	115
137	Residential project #228 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.34	N/A	15	210
138	Residential project #229 by Meridian Energy	Austin, TX	Travis	Travis	N/A	Sharp 167W	3.34	N/A	12	175
139	Residential project #233 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.34	N/A	30	185
140	Residential project #234 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	6.68	N/A	15	120
141	Residential project #238 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	4	N/A	30	180
142	Residential project #243 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sharp 165W	3.3	N/A	28	170
143	Residential project #246 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	2.7	N/A	28	170
144	Residential project #247 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	45	210

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
145	Residential project #252 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sharp 170w	3.1	N/A	20	200
146	Residential project #268 by Meridian Energy	Austin, TX	Travis	Travis	N/A	sanyo 200w	3.2	N/A	25	210
147	Residential project #272 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	20	200
148	Residential project #219 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
149	Residential project #221 by Meridian Energy	Del Valle, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
150	Residential project #239 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
151	Residential project #244 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
152	Residential project #256 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
153	Residential project #266 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
154	Residential project #281 by Meridian Energy	New Braunfels, TX	Guadalupe	Guadalupe	N/A	N/A	3	N/A	N/A	N/A
155	Residential project #289 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
156	Residential project #214 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
157	Residential project #212 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
158	Residential project #210 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
159	Residential project #208 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
160	Residential project #207 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
161	Residential project #206 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
162	Residential project #205 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1	N/A	N/A	N/A
163	Residential project #204 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
164	Residential project #200 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
165	Residential project #195 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	2	N/A	N/A	N/A
166	Residential project #194 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
167	Residential project #192 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
168	Residential project #190 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
169	Residential project #188 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
170	Residential project #187 by Meridian Energy	Austin, TX	Travis	Travis	N/A	N/A	1.3	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
171	Residential project #184 by Meridian Energy	Frisco, TX	collin	collin	N/A	N/A	6	N/A	N/A	N/A
172	Residential project #183 by Meridian Energy	Spicewood, TX	Burnet		N/A	N/A	1.8	N/A	N/A	N/A
173	Residential project #181 by Meridian Energy	San Antonio, TX	Bexar	Bexar	N/A	N/A	3	N/A	N/A	N/A
174	Residential project #180 by Meridian Energy	Llano, TX	Llano		N/A	N/A	3	N/A	N/A	N/A
175	Residential project #165 by Meridian Energy	Blanco, TX	Blanco		N/A	N/A	1	N/A	N/A	N/A
176	Residential project #119 by Meridian Energy	Wimberly, TX	Hays		N/A	N/A	1.4	N/A	N/A	N/A
177	Residential project #102 by Meridian Energy	Mexia, TX	Limestone		N/A	N/A	1.5	N/A	N/A	N/A
178	Residential project #279 by Meridian Energy	Fischer, TX	Comal	Comal	N/A	N/A	6	N/A	N/A	N/A
179	Residential project #105 by Meridian Energy	Brenham, TX	Washington		N/A	N/A	3.2	N/A	N/A	N/A
180	Residential project #127 by Meridian Energy	Jonestown, TX	Travis	Travis	N/A	N/A	1.08	N/A	N/A	N/A
181	Residential project #161 by Meridian Energy	Alpine, TX	Brewster		N/A	N/A	3.96	N/A	N/A	N/A
182	Residential project #174 by Meridian Energy	Ft.Davis, TX	Jeff Davis		N/A	N/A	2.64	N/A	N/A	N/A
183	Residential project #162 by Meridian Energy	Spicewood, TX	Burnet		N/A	N/A	0.15	N/A	N/A	N/A
184	Residential project #160 by Meridian Energy	Elgin, TX	Travis	Travis	N/A	N/A	0.308	N/A	N/A	N/A
185	Tarrant regional water district	Ft Worth, TX	Travis		N/A	N/A	238	N/A	N/A	N/A
186	City of Austin, Service center# 5	Austin, TX	Travis	Travis	N/A	N/A	23.4	N/A	N/A	N/A
187	City of Austin, Service center# 6	Austin, TX	Travis	Travis	N/A	N/A	55900	N/A	N/A	N/A
188	City of Austin, fire station #27	Austin, TX	Travis	Travis	N/A	N/A	4.16	N/A	N/A	N/A
189	City of Austin, St.John's	Austin, TX	Travis	Travis	N/A	N/A	4.94	N/A	N/A	N/A
190	City of Austin, Far South Austin Public Health	Austin, TX	Travis	Travis	N/A	N/A	5.72	N/A	N/A	N/A
191	waco chamber of commerce building	Austin, TX	Travis	Travis	N/A	N/A	9.6	N/A	N/A	N/A
192	Houston Code Building	Houston, TX	Harris	Harris	N/A	N/A	6.6	N/A	N/A	N/A
193	city of houston annex building	Houston, TX	Harris	Harris	N/A	N/A	6.6	N/A	N/A	N/A
194	Kirby junior high school, Wichita falls	Wichita Falls, TX	Wichita		N/A	N/A	1	N/A	N/A	N/A
195	Garnell Construction	Wichita Falls, TX	Wichita		N/A	N/A	4.2	N/A	N/A	N/A
196	Green Builders	Austin, TX	Travis	Travis	N/A	N/A	2.8	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
197	Green Builders	Austin, TX	Travis	Travis	N/A	N/A	1.6	N/A	N/A	N/A
198	Children's museum of Houston	Houston, TX	Harris	Harris	N/A	N/A	8.8	N/A	N/A	N/A
199	Chipotle Mexican Grill	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
200	Discovery Green	Houston, TX	Harris	Harris	N/A	N/A	49.9	N/A	N/A	N/A
201	Jason's Deli	Austin, TX	Travis	Travis	N/A	N/A	8.8	N/A	N/A	N/A
202	Tejas securities building	Austin, TX	Travis	Travis	N/A	N/A	22.4	N/A	N/A	N/A
203	Jason's Deli	Beaumont, TX	Jefferson		N/A	N/A	7.7	N/A	N/A	N/A
204	Chipotle Mexican Grill	Austin, TX	Travis	Travis	N/A	N/A	3.8	N/A	N/A	N/A
205	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	3.5	N/A	N/A	N/A
206	Residential project by Standard Renewable Energy	Carrollton, TX	Denton		N/A	N/A	2	N/A	N/A	N/A
207	Residential project by Standard Renewable Energy	Galveston, TX	Galveston		N/A	N/A	3.8	N/A	N/A	N/A
208	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
209	Residential project by Standard Renewable Energy	Bellaire, TX	Harris		N/A	N/A	3.2	N/A	N/A	N/A
210	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
211	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
212	Residential project by Standard Renewable Energy	Galveston, TX	Galveston		N/A	N/A	3.2	N/A	N/A	N/A
213	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
214	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
215	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
216	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
217	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.4	N/A	N/A	N/A
218	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.4	N/A	N/A	N/A
219	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	3.5	N/A	N/A	N/A
220	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	3.1	N/A	N/A	N/A
221	Residential project by Standard Renewable Energy	Shavano Park, TX	Bexar		N/A	N/A	4.6	N/A	N/A	N/A
222	Residential project by Standard Renewable Energy	Katy, TX	Harris		N/A	N/A	4.8	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
223	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	4.8	N/A	N/A	N/A
224	Residential project by Standard Renewable Energy	Dallas, TX	Dallas	Dallas	N/A	N/A	4.6	N/A	N/A	N/A
225	Residential project by Standard Renewable Energy	Wimberly, TX	Hays		N/A	N/A	5.1	N/A	N/A	N/A
226	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	6	N/A	N/A	N/A
227	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
228	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
229	Residential project by Standard Renewable Energy	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
230	Residential project by Standard Renewable Energy	Houston, TX	Harris	Harris	N/A	N/A	6.1	N/A	N/A	N/A
231	Residential project by Standard Renewable Energy	Texas City, TX	Galveston		N/A	N/A	8.5	N/A	N/A	N/A
232	Colorado acres	Webb county, Tx	Webb		N/A	N/A	7.2	N/A	N/A	N/A
233	Austin Parmer Elementary	Austin, TX	Travis	Travis	N/A	N/A	3.12	N/A	N/A	N/A
234	Residential project by Meridian Energy Systems	Dallas, TX	Dallas	Dallas	N/A	N/A	3.4	N/A	N/A	N/A
235	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.4	N/A	N/A	N/A
236	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	9	N/A	N/A	N/A
237	Residential project by Meridian Energy Systems	Grapevine, TX	Tarrant		N/A	N/A	2.7	N/A	N/A	N/A
238	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5	N/A	N/A	N/A
239	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.2	N/A	N/A	N/A
240	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.8	N/A	N/A	N/A
241	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	7.9	N/A	N/A	N/A
242	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
243	Residential project by Meridian Energy Systems	Plano, TX	Collin	Collin	N/A	N/A	7.2	N/A	N/A	N/A
244	Residential project by Meridian Energy Systems	Wimberly, TX	Hays		N/A	N/A	6	N/A	N/A	N/A
245	Residential project by Meridian Energy Systems	Colleyville,TX	Tarrant		N/A	N/A	3.1	N/A	N/A	N/A
246	Residential project by Meridian Energy Systems	Farmers Branch, TX	Dallas		N/A	N/A	24.3	N/A	N/A	N/A
247	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.3	N/A	N/A	N/A
248	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
249	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	25.3	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
250	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.2	N/A	N/A	N/A
251	Residential project by Meridian Energy Systems	Wimberly, TX	Hays		N/A	N/A	3.2	N/A	N/A	N/A
252	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	7.8	N/A	N/A	N/A
253	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.3	N/A	N/A	N/A
254	Residential project by Meridian Energy Systems	Cibolo, TX	Guadalupe		N/A	N/A	3.9	N/A	N/A	N/A
255	Frisco zero energy home	Frisco, TX	collin	collin	N/A	N/A	6	N/A	N/A	N/A
256	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	2.7	N/A	N/A	N/A
257	Residential project by Meridian Energy Systems	Garland, TX	Dallas		N/A	N/A	4.6	N/A	N/A	N/A
258	Residential project by Meridian Energy Systems	San Antonio, TX	Bexar	Bexar	N/A	N/A	9.3	N/A	N/A	N/A
259	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	2.9	N/A	N/A	N/A
260	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.3	N/A	N/A	N/A
261	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.8	N/A	N/A	N/A
262	Residential project by Meridian Energy Systems	Spicewood, TX	Burnet		N/A	N/A	5.8	N/A	N/A	N/A
263	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
264	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	6.4	N/A	N/A	N/A
265	Residential project by Meridian Energy Systems	Plano, TX	Collin	Collin	N/A	N/A	8.1	N/A	N/A	N/A
266	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.3	N/A	N/A	N/A
267	Residential project by Meridian Energy Systems	Burnet, TX	Burnet	Burnet	N/A	N/A	2.9	N/A	N/A	N/A
268	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
269	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.3	N/A	N/A	N/A
270	Residential project by Meridian Energy Systems	Corsicana, TX	Navarro		N/A	N/A	3.2	N/A	N/A	N/A
271	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.6	N/A	N/A	N/A
272	Residential project by Meridian Energy Systems	Dallas, TX	Dallas	Dallas	N/A	N/A	3.3	N/A	N/A	N/A
273	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	2.5	N/A	N/A	N/A
274	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
275	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	10.9	N/A	N/A	N/A
276	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	5.8	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
277	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.3	N/A	N/A	N/A
278	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
279	Residential project by Meridian Energy Systems	Bastrop, TX	Bastrop		N/A	N/A	0.2	N/A	N/A	N/A
280	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	19	N/A	N/A	N/A
281	Residential project by Meridian Energy Systems	Fortworth, TX	Tarrant		N/A	N/A	2.1	N/A	N/A	N/A
282	Residential project by Meridian Energy Systems	Dallas, TX	Dallas	Dallas	N/A	N/A	2.1	N/A	N/A	N/A
283	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
284	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	1.7	N/A	N/A	N/A
285	Residential project by Meridian Energy Systems	Dallas, TX	Dallas	Dallas	N/A	N/A	4.4	N/A	N/A	N/A
286	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.1	N/A	N/A	N/A
287	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
288	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.3	N/A	N/A	N/A
289	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	6.8	N/A	N/A	N/A
290	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	3.4	N/A	N/A	N/A
291	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	4	N/A	N/A	N/A
292	Residential project by Meridian Energy Systems	Grapevine, TX	Tarrant		N/A	N/A	6	N/A	N/A	N/A
293	Residential project by Meridian Energy Systems	Spicewood, TX	Burnet		N/A	N/A	0.2	N/A	N/A	N/A
294	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	2.3	N/A	N/A	N/A
295	Residential project by Meridian Energy Systems	Fortworth, TX	Tarrant		N/A	N/A	3.9	N/A	N/A	N/A
296	Residential project by Meridian Energy Systems	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A
297	American Bank Of Commerce	Austin, TX	Travis	Travis	N/A	N/A	23.3	N/A	N/A	N/A
298	Applied Materials	Austin, TX	Travis	Travis	N/A	N/A	24.4	N/A	N/A	N/A
299	Bluffs Landing senior village	Round Rock, TX	Williamson	Williamson	N/A	N/A	102	N/A	N/A	N/A
300	Castlerock Pet Hospital	Georgetown, TX	Williamson		N/A	N/A	3.8	N/A	N/A	N/A
301	H-E-B #23	Austin, TX	Travis	Travis	N/A	N/A	23.3	N/A	N/A	N/A
302	Lower physical fitness center	Texas City, TX	Galveston		N/A	N/A	45.4	N/A	N/A	N/A
303	Oak Creek plaza	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
304	Pearl Brewery	San Antonio, TX	Bexar	Bexar	N/A	N/A	200.3	N/A	N/A	N/A
305	Pfluger Associates Architects	Austin, TX	Travis	Travis	N/A	N/A	24.5	N/A	N/A	N/A
306	REI	Round Rock, TX	Williamson	Williamson	N/A	N/A	17	N/A	N/A	N/A
307	Stricty Pediatrics	Austin, TX	Travis	Travis	N/A	N/A	23.4	N/A	N/A	N/A
308	The overlook	Austin, TX	Travis	Travis	N/A	N/A	46.2	N/A	N/A	N/A
309	University Federal Credit union	Austin, TX	Travis	Travis	N/A	N/A	24.6	N/A	N/A	N/A
310	Austin Community College	Austin, TX	Travis	Travis	N/A	N/A	2.4	N/A	N/A	N/A
311	Friends Meeting	Austin, TX	Travis	Travis	N/A	N/A	11.2	N/A	N/A	N/A
312	Maktab Tarighat Oveyssi Shahmaghsoudi	Frisco, TX	collin	collin	N/A	N/A	52.4	N/A	N/A	N/A
313	McLennan Community College Emergency services	Waco, TX	Mc Lennan		N/A	N/A	47.3	N/A	N/A	N/A
314	Shangrila Botanical gardens and nature center	Orange, TX	Orange		N/A	N/A	10.1	N/A	N/A	N/A
315	State Energy Conservation Office-Solar fro Schools	Austin, TX	Travis	Travis	N/A	N/A	1.8	N/A	N/A	N/A
316	State Energy Conservation Office-Solar fro Schools	Austin, TX	Travis	Travis	N/A	N/A	4.1	N/A	N/A	N/A
317	TXU Energy Solar Academy	Dallas, TX	Dallas	Dallas	N/A	N/A	1	N/A	N/A	N/A
318	Winston School	Dallas, TX	Dallas	Dallas	N/A	N/A	73	N/A	N/A	N/A
319	Project by Standard renewable energy	Austin, TX	Travis	Travis	N/A	N/A	14	N/A	N/A	N/A
320	Project by Standard renewable energy	Austin, TX	Travis	Travis	N/A	N/A	14	N/A	N/A	N/A
321	Project by Standard renewable energy	Austin, TX	Travis	Travis	N/A	N/A	14	N/A	N/A	N/A
322	Project by Standard renewable energy	Marfa, TX	Presidio		N/A	N/A	5	N/A	N/A	N/A
323	Project by Standard renewable energy	Frankston, TX	Anderson		N/A	N/A	1.2	N/A	N/A	N/A
324	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
325	Project by solar community	Palestine, TX	Anderson		N/A	N/A	4	N/A	N/A	N/A
326	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	10	N/A	N/A	N/A
327	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
328	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
329	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
330	Project by solar community	Palestine, TX	Anderson		N/A	N/A	6	N/A	N/A	N/A

Table 6-2: Solar Photovoltaic Cell Projects: Data and Information (cont.)

Project No	Solar Project	City/Town	County	County for ECALC	Date	PV Modules	Capacity(kW)	Total Area (sqft)	Slope	Azimuth (South=180)
331	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3.15	N/A	N/A	N/A
332	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
333	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
334	Project by solar community	Marble falls, TX	Burnet		N/A	N/A	3	N/A	N/A	N/A
335	Project by solar community	Dallas, TX	Dallas	Dallas	N/A	N/A	4.2	N/A	N/A	N/A
336	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	5	N/A	N/A	N/A
337	Project by solar community	Palestine, TX	Anderson		N/A	N/A	7	N/A	N/A	N/A
338	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	8.4	N/A	N/A	N/A
339	Project by solar community	Georgetown, TX	Williamson		N/A	N/A	4.2	N/A	N/A	N/A
340	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	20	N/A	N/A	N/A
341	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.2	N/A	N/A	N/A
342	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A
343	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3.15	N/A	N/A	N/A
344	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A
345	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A
346	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.3	N/A	N/A	N/A
347	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A
348	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6	N/A	N/A	N/A
349	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3.15	N/A	N/A	N/A
350	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6	N/A	N/A	N/A
351	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	6.5	N/A	N/A	N/A
352	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	4.2	N/A	N/A	N/A
353	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3.2	N/A	N/A	N/A
354	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	5	N/A	N/A	N/A
355	Project by solar community	Marble falls, TX	Burnet		N/A	N/A	4.5	N/A	N/A	N/A
356	Project by solar community	Austin, TX	Travis	Travis	N/A	N/A	3	N/A	N/A	N/A

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season						
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007		
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
1	Vliet Residence	Travis	2415	9.27	5.22	3465	3.92	2.17	3109	8	0.03	0.02	11	0.01	0	9
2	Del Rio High School	Bexar	6165	16.26	5.85	9155	10.17	10.1	10013	19	0.05	0.02	28	0.03	0.02	30
3	Uvalde Junior High School	Bexar	6165	16.26	5.85	9155	10.17	10.1	10013	19	0.05	0.02	28	0.03	0.02	30
4	El Campo Middle School	Brazoria	5513	13.31	11.41	8670	9.54	7.4	7790	17	0.04	0.03	26	0.03	0.02	23
5	Childress High School	Denton	6284	24.12	13.98	9081	10.22	5.71	8103	20	0.08	0.04	28	0.03	0.01	24
6	Central High School	Williamson	6151	23.62	13.29	8824	9.99	5.53	7917	19	0.07	0.04	27	0.03	0.01	23
7	Abilene School District Planetarium	Hood	6284	24.12	19.98	9081	10.22	5.71	8103	20	0.08	0.04	28	0.03	0.01	24
9	Martin High School	Nueces	5373	14.91	3.09	7478	6.45	2.15	6320	18	0.05	0.01	25	0.02	0	20
11	Calallen High School	Nueces	5567	15.45	3.2	7748	6.68	2.23	6549	17	0.05	0.01	24	0.02	0	20
12	Spring Hill Junior High School	Smith	5749	22.35	12.69	8258	9.4	5.26	7408	18	0.07	0.04	26	0.03	0.01	22
15	Sonora High School	Travis	6131	23.54	13.25	8795	9.96	5.51	7891	20	0.07	0.04	28	0.03	0.01	24
16	UT Health Science Center	Harris	3545	5.92	5.01	3835	4.26	3.33	3464	11	0.02	0.01	11	0.01	0.01	10
17	Mission High School	Nueces	5565	15.45	3.2	7746	6.68	2.23	6546	17	0.05	0.01	24	0.02	0	20
19	Rio Hondo High School	Nueces	5565	15.45	3.2	7746	6.68	2.23	6546	17	0.05	0.01	24	0.02	0	20
20	Houston Ship Channel	Harris	942	1.57	1.33	1019	1.13	0.89	920	3	0	0	3	0	0	3
21	Maplewood Elementary School	Travis	2408	9.25	5.2	3455	3.91	2.17	3100	7	0.03	0.02	11	0.01	0	9
22	Brooksmith ISD	Hood	670	2.57	1.49	969	1.09	0.61	864	1	0.01	0	2	0	0	2
23	Hamlin ISD	Parker	1230	4.78	2.71	1766	2.01	1.13	1585	4	0.01	0.01	6	0.01	0	5
24	Ira ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
25	John Jay High School	Bexar	1013	2.67	0.96	1505	1.67	1.66	1646	3	0.01	0	4	0	0	4
27	Holliday ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
28	River Road ISD	Parker	1047	4.07	2.31	1504	1.71	0.96	1349	3	0.01	0.01	4	0	0	3
29	Eagle Pass High School - CC Winn	Bexar	1207	3.18	1.15	1792	1.99	1.98	1960	4	0.01	0	6	0.01	0	6
30	James Madison High School	Bexar	1207	3.18	1.15	1792	1.99	1.98	1960	4	0.01	0	6	0.01	0	6
31	Univeresity of Texas Medical Branch	Galveston	24763	59.8	51.24	38942	42.85	33.23	34990	74	0.18	0.15	116	0.12	0.08	101
33	City Public Services of San Antonio, Northside	Bexar	24895	65.67	23.63	36970	41.08	40.79	40436	75	0.2	0.07	112	0.12	0.08	120

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions (cont.)

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season						
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007		
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
35	Blue Ridge ISD	Collin	1230	4.72	2.73	1777	2	1.12	1586	4	0.01	0.01	6	0.01	0	5
36	Bryker Woods Elementary School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
37	East Central ISD	Bexar	1411	3.72	1.34	2096	2.33	2.31	2292	4	0.01	0	6	0.01	0	6
38	Alvin High School	Brazoria	1490	3.6	3.08	2344	2.58	2	2106	4	0.01	0.01	7	0.01	0	6
39	Seabrook Intermediate School	Harris	1255	2.1	1.77	1358	1.51	1.18	1226	3	0.01	0	4	0	0	3
40	Kealing Middle School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
41	Canyon High School	Comal	1681	4.43	1.6	2496	2.77	2.75	2730	5	0.01	0.01	8	0.01	0.01	8
42	Dallas ISD Environmental Education	Dallas	1704	6.62	3.76	2448	2.79	1.56	2196	5	0.02	0.01	7	0.01	0	6
43	Junction High School	Travis	1404	5.39	3.03	2014	2.28	1.26	1807	4	0.01	0.01	5	0.01	0	5
44	Roosevelt High School	Bexar	1669	4.4	1.58	2478	2.75	2.73	2711	5	0.01	0	7	0.01	0.01	8
45	City Public Services Primary Control	Bexar	24895	65.67	23.63	36970	41.08	40.79	40436	75	0.2	0.07	112	0.12	0.08	120
46	NASA Johnson Space Center	Harris	12504	20.87	17.66	13.53	15.04	11.75	12216	37	0.06	0.05	40	0.04	0.03	35
47	La Grange Intermediate School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
48	Weimar High School	Fort Bend	1588	3.84	3.25	2490	2.77	2.16	2249	5	0.01	0.01	7	0.01	0.01	7
49	Marion Middle School	Guadalupe	1779	4.69	1.69	2641	2.94	2.91	2889	5	0.01	0.01	8	0.01	0.01	9
50	Giddings Middle School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
51	Schulenburg Elementary School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
52	Smithville Junior High School	Bastrop	1774	6.9	3.92	2548	2.9	1.62	2286	5	0.02	0.01	8	0.01	0	7
53	Utopia ISD	Bexar	1779	4.69	1.69	2641	2.94	2.91	2889	5	0.01	0.01	8	0.01	0.01	9
54	Brenham Middle School	Montgomery	1588	2.65	2.24	1718	1.91	1.49	1552	5	0.01	0.01	5	0.01	0	4
55	Cuero Junior High School	Victoria	1624	4.51	0.93	2260	1.95	0.65	1910	5	0.01	0	7	0.01	0	6
56	Bluebonnet Elementary School	Caldwell	1774	4.93	1.02	2469	2.13	0.71	2087	5	0.01	0	7	0.01	0	6
57	McKinney Green Building	Collin	56096	215.35	124.75	81061	91.21	50.98	72330	171	0.66	0.38	248	0.28	0.07	213
59	Bedichek Middle Shool	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
60	Blanton Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
61	Cunningham elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19

Table 6-3: Solar Photovoltaic Cell Projects: Energy and NOx Reductions (cont.)

Proj. No	Project	County For Ecalc	Annual Energy Savings (for base year conditions) and Emissions Reduction In lbs/year							Annual Energy Savings (for base year conditions) and Average Emissions Reduction In lbs/day Per Ozone Season					
			Annual Energy Consumptio	1999			2007			Annual Energy Consumpti	1999			2007	
				NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
62	Garza High School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
63	Martin Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
64	Murchison Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
65	O'Henry Middle School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
66	Pond Springs Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
67	Westwood High School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
68	Zilker Elementary School	Travis	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
69	Davis Elementary School	Williamson	5150	19.78	11.13	7389	8.37	4.63	6629	16	0.06	0.03	22	0.03	0.01	19
70	Brenham Jr. High School	Harris	826	1.38	1.17	893	0.99	0.78	807	2	0	0	3	0	0	2
71	Harper School	Travis	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
72	Kendall Elementary School	Bexar	1215	3.21	1.15	1805	2.01	1.99	1974	4	0.01	0	5	0.01	0	6
73	Leonard Shanklin Elementary School	Caldwell	1212	3.36	0.7	1687	1.46	0.49	1426	4	0.01	0	5	0	0	4
74	Hempstead Middle School	Harris	1083	1.81	1.53	1171	1.3	1.02	1058	3	0.01	0	3	0	0	3
75	Llano Junior High School	Travis	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
76	San Marcos Electric Utility	Travis	925	3.55	2	1326	1.5	0.83	1190	3	0.01	0.01	4	0	0	3
77	Lampasas Middle School	Williamson	1212	4.65	2.62	1739	1.97	1.09	1560	4	0.01	0.01	5	0.01	0	4
78	Bastrop Intermediate School	Bastrop	1212	4.71	2.67	1741	1.98	1.11	1562	4	0.01	0.01	5	0.01	0	4
79	Flatonia Elementary School	Caldwell	1212	3.36	0.7	1687	1.46	0.49	1426	4	0.01	0	5	0	0	4
80	Waelder ISD	Caldwell	925	2.57	0.53	1287	1.11	0.37	1088	3	0.01	0	4	0	0	3
84	Aircraft Obstruction Light	Harris	2127	3.65	3	2301	2.56	2	2078	6	0.01	0.01	7	0.01	0	6
85	Learning Center at Sheldon Lake State Park	Harris	1372	2.29	1.94	1484	1.65	1.29	1340	4	0.01	0.01	4	0	0	4
86	Learning Center at Sheldon Lake State Park	Harris	1072	1.79	1.51	1160	1.29	1.01	1048	3	0.01	0	4	0	0	3
88	Solar Powered Water Pumping	Montgomery	3545	5.92	5.01	3835	4.26	3.33	3464	11	0.02	0.01	11	0.01	0.01	10
89	Solar Powered Reverse Osmosis in	Nueces	8187	22.73	4.7	11395	9.83	3.28	9630	25	0.07	0.01	35	0.03	0.01	28
113	Solar Powered Water Purification	Victoria	1488	4.13	0.86	2071	1.79	0.6	1750	4	0.01	0	6	0.01	0	5
114	City Hall, Austin, Texas	Travis	13069	50.19	28.24	18747	21.23	11.75	16821	39	0.15	0.09	57	0.06	0.02	49
	TOTAL		**362212**	**9074.6**	**594.79**	**465535**	**8558.3**	**360.65**	**449179**	**1101**	**7999.2**	**1.72**	**1446**	**8029.6**	**0.62**	**1310**

Table 6-4: Solar Thermal Projects

Project No	City	County	County for eCalc	Project Purpose	Model	Collector Area (sqft)	Number of collectors	Total Area (sqft)	Slope (degree)	Azimuth (i.e. South=0, West (-) and East (+))	Fluid
1	Austin	Travis	Travis	Domestic Hot Water (DHW)	N/A	N/A	2	N/A	N/A	0	Antifreeze
2	Austin	Travis	Travis	Domestic Hot Water (DHW)	SS HX Drainback	26.25	3	78.75	20	0	Water
3	Round Rock	Willamson	Willamson	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	-90	Water
4	Dripping	Hays	Hays	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	20	Water
5	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	0	Water
6	San Antonio	Bexar	Bexar	Pool Heating System	FS collector	32	8	256	20	-45	Water
7	N/A	N/A	N/A	Domestic Hot Water (DHW)	SS HX Drainback	26.25	3	78.75	20	-45	Water
8	N/A	N/A	N/A	Domestic Hot Water (DHW)	SS HX Drainback	26.25	2	52.5	20	-45	Water
9	Midland	Midland	N/A	Pool Heating System-city of midland aquatic center	HC 50 collectors-make:APS	50	256	12800	N/A	N/A	Water
10	Lubbock	Lubbock	N/A	Pool Heating System-Lubbock TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
11	Corpus Christi	Nueces	N/A	Pool Heating System-Corpus Christi TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
12	Richmond	Fort Bend	N/A	Pool Heating System-Richmond TX State School	HC 50 collectors-make:APS	50	36	1800	N/A	N/A	Water
13	Elpaso	Elpaso	N/A	Pool Heating System-University of Elpaso recreation facility	HC 50 collectors-make:APS	50	120	6000	N/A	N/A	Water
14	Elpaso	Elpaso	N/A	Pool Heating System-University of Elpaso recreation facility	HC 50 collectors-make:APS	50	128	6400	N/A	N/A	Water
15	edinburg	Hidalgo	N/A	Pool heating system for Gym spa	make : APS	N/A	34	600+	N/A	N/A	Water
16	pearland	Brazoria	N/A	Pool heating system-residential	make : APS	N/A	7	N/A	N/A	N/A	water
17	cleveland	Liberty	N/A	Domestic Hot Water (DHW)	make : APS	N/A	N/A	N/A	N/A	N/A	water
18	Austin	Travis	Travis	Pool hating system at the Jester Club	make: FAFCO	N/A	N/A	N/A	N/A	N/A	water
19	Austin	Travis	Travis	pool heating at Quenciera@Barton Creek	make: FAFCO	N/A	N/A	N/A	N/A	N/A	water
20	Laredo	Webb	Nueces	Pool heating at Tijerina Ranch	make: FAFCO	N/A	N/A	N/A	N/A	N/A	water
21	San Antonio	Bexar	Bexar	DHW system-Apartment high rise-The army resident community	30 tube Apricus collectors	25.8	180	4644	N/A	N/A	water
22	San Antonio	Bexar	Bexar	DHW system-Assisted Living Facility-The army resident community	30 tube Apricus collectors	25.8	5	129	N/A	N/A	water
23	Victoria	Victoria		Domestic Hot Water (DHW)	30 tube Apricus collectors	25.8	2	51.6	N/A	N/A	water
24	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW)-resident project by Brooks energy & sutainability lab	N/A	N/A	N/A	N/A	N/A	N/A	water
25	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW at city public service-northside	N/A	N/A	N/A	5000	N/A	N/A	water
26	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW)-Bexar County Adult Jail Annex	N/A	N/A	N/A	N/A	N/A	N/A	water
27	San Antonio	Bexar	Bexar	Domestic Hot Water (DHW)	Progressive Tube Technology Pt-50	N/A	N/A	N/A	N/A	N/A	water
28	San Antonio	Bexar	Bexar	Historic Gardens phase II project by SADA	N/A	N/A	N/A	N/A	N/A	N/A	water

Table 6-5: Solar Thermal Projects Emissions Reductions

		Annual Energy Savings (for base year conditions) and Emissions Reduction							Average per Ozone Season Day (for base year conditions) and Emissions Reduction						
		Annual Energy Consumption (kWh/yr)	1999			2007			Annual Energy Consumption (kWh/yr)	1999			2007		
Project	County for ECALC		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2		NO_x	SO_x	CO_2	NO_x	SO_x	CO_2
2	Travis	4134	15.87	8.93	5930	6.71	3.72	5320	14	0.05	0.03	20	0.02	0.01	17
3	Willamson	3211	12.33	6.94	4606	5.22	2.89	4133	13	0.05	0.03	18	0.02	0	16
4	Hays	3469	9.16	2.44	4791	4.41	1.14	4234	12	0.03	0.01	17	0.02	0	15
5	Bexar	3469	9.15	3.29	5152	5.73	5.68	5635	12	0.03	0.01	18	0.02	0.01	19
6	Bexar	26235	69.2	24.9	38960	43.3	42.98	42.612	87	0.23	0.08	130	0.14	0.09	140
TOTAL		**40518**	**115.71**	**46.5**	**59439**	**65.37**	**56.41**	**19364.6**	**138**	**0.39**	**0.16**	**203**	**0.22**	**0.11**	**207**

Table 6-6: Solar Thermal Special Project

Special Case	
Location	Fort Sam Houston, San Antonio TX
Date	3-Jun
Collector	Roof Mounted Parabolic Trough
Number of collectors	129
Total Aperture area (sqft)	4515
Maximum operation temperature (°F)	400
Annual Energy Consumption (KWh/yr)	270583
Annual Energy Consumption OSD (KWh/yr) (KWh/yr)	741.3

Table 6-7: Hydropower Plant Information

S.No	Utility Name	Plant Name	County	Initial Year Of Operation	Capacity in MW	STATUS
1	Guadalupe Blanco River Auth	Abbott TP 3	Victoria	1927	1.4	operational
2	Guadalupe Blanco River Auth	Abbott TP 3	Victoria	1927	1.4	operational
3	Guadalupe Blanco River Auth	Dunlap TP 1	Guadalupe	1927	1.8	operational
4	Guadalupe Blanco River Auth	Dunlap TP 1	Guadalupe	1927	1.8	operational
5	Guadalupe Blanco River Auth	Nolte	Williamson	1927	1.2	operational
6	Guadalupe Blanco River Auth	Nolte	Williamson	1927	1.2	operational
7	Guadalupe Blanco River Auth	H 4	Guadalupe	1931	2.4	operational
8	Guadalupe Blanco River Auth	H 5	Guadalupe	1931	2.4	operational
9	Guadalupe Blanco River Auth	TP 4	Guadalupe	1932	2.4	operational
10	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
11	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
12	Maverick Cty Water Control & Improvement	Eagle Pass	Maverick	1932	3.2	operational
13	Lower Colorado River Authority	Buchanan	Burnet	1938	18.3	operational
14	Lower Colorado River Authority	Buchanan	Burnet	1938	18.3	operational
15	Lower Colorado River Authority	Buchanan	Burnet	1938	11.2	operational
16	Lower Colorado River Authority	Inks	Burnet	1938	15	operational
17	Lower Colorado River Authority	Austin	Lampasas	1941	8	operational
18	Lower Colorado River Authority	Austin	Lampasas	1941	8	operational
19	Lower Colorado River Authority	Marshall Ford	Travis	1941	34	operational
20	Lower Colorado River Authority	Marshall Ford	Travis	1941	34.5	operational
21	Lower Colorado River Authority	Marshall Ford	Travis	1941	34	operational
22	Brazos River Authority	Morris Sheppard	Palo Pinto	1942	12.5	operational
23	Brazos River Authority	Morris Sheppard	Palo Pinto	1942	12.5	operational

Table 6-7:Hydropower Plant Information (cont.)

S.No	Utility Name	Plant Name	County	Initial Year Of Operation	Capacity in MW	STATUS
24	USCE-Tulsa District	Denison	Grayson	1945	35	operational
25	USCE-Tulsa District	Denison	Grayson	1949	35	operational
26	Lower Colorado River Authority	Granite Shoals	Burnet	1951	30	operational
27	Lower Colorado River Authority	Granite Shoals	Burnet	1951	30	operational
28	Lower Colorado River Authority	Marble Falls	Burnet	1951	15	operational
29	Lower Colorado River Authority	Marble Falls	Burnet	1951	15	operational
30	USCE-Fort Worth District	Whitney	Bosque	1953	15	operational
31	USCE-Fort Worth District	Whitney	Bosque	1953	15	operational
32	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
33	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
34	International Bound & Wtr Comm	Falcon Dam & Power	Zapata	1954	10.5	operational
35	USCE-Fort Worth District	Sam Rayburn	Jasper	1965	26	operational
36	USCE-Fort Worth District	Sam Rayburn	Jasper	1965	26	operational
37	Entergy Gulf States Inc	Toledo Bend	Newton	1969	40.5	operational
38	Entergy Gulf States Inc	Toledo Bend	Newton	1969	40.5	operational
39	International Bound & Wtr Comm	Amistad Dam & Power	Valverde	1983	33	operational
40	International Bound & Wtr Comm	Amistad Dam & Power	Valverde	1983	33	Operational
41	Guadalupe Blanco River Auth	Canyon	Randall	1989	3	Operational
42	Guadalupe Blanco River Auth	Canyon	Randall	1989	3	Operational
43	USCE-Fort Worth District	Robert D Willis	Harris	1989	4	Operational
44	USCE-Fort Worth District	Robert D Willis	Harris	1989	4	Operational
45	City of Garland	Lewisville	Denton	1992	2.8	Operational
				Total	669.2	MW

Table 6-8: Geothermal Heat Pump Energy Projects

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
1	Birdville High School Campus	Denton	2001	N/A	N/A
2	Texas Motor Speedway	Denton	1998	N/A	N/A
3	George W. Bush's ranch	McLennan	2001	14	N/A
4	Esperanza del Sol, Dallas (Hope of the Sun)	Dallas	1994	18	15,276
5	Hillside Oaks, East Dallas	Dallas	1997	366	276,120
6	Pease Elementary School, Austin	Travis	1997	90	39,162
7	Brooke Elementary School	Travis	1997	150	51,605
8	Govalle Elementary School	Travis	1997	230	89,319
9	Bailey Middle School, Austin	Travis	1997	512	200,000
10	Home in Iowa Park	Wichita	1997	1	1,668
11	The Home of the Future	Dallas	1997	13	4,573
12	Birdville Athletic Complex / Stadium	Tarrant	post 1992	N/A	60,000
13	Frisco ISD Administration Building and Network Operations	Collin	post 1992	N/A	20,000+
14	Aubrey Athletic Complex / Stadium	Denton	post 2002	64	25,807
15	Lake Dallas Athletic Complex / Stadium	Denton	post 2001	63	43,500
16	Wakeland High School	Collin	post 1992	1010.25	335,932
17	Lovejoy High School	Collin	post 2004	792.5	216,290
18	Grand Prairie High Ninth Grade Center	Dallas	post 2000	598	150,000+
19	South Grand Prairie High Ninth Grade Center	Dallas	post 2001	atleast 133	100,000+
20	Renovations to HVAC System at South Grand Prairie High	Dallas	post 2001	69	12,500
21	Renovations to HVAC System at South Grand Prairie High	Dallas	post 2002	64	49,000
22	David Daniels Elementary	Dallas	post 1992	N/A	70,000+
23	Edelweiss Daniels Elementary	Dallas	post 2000	305	72,872
24	Crockett Elementary	Dallas	post 2000	305	72,872
25	Kirby Elementary	Dallas	post 2000	305	72,872
26	Renovations to HVAC System at Lee Middle School	Dallas	post 1992	214	136,600 +

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
27	Rebuild of Lee Middle School (Fire Damage)	Dallas	post 2000	64	2,800
28	Renovations/Additions to Adams Middle School	Dallas	post 1992	N/A	N/A
29	Renovations/Additions to North Oaks Middle School	Tarrant	post 1992	N/A	71,000+
30	Renovations/Additions to North Richland Middle School	Tarrant	post 1992	273	80,000+
31	Watauga Middle School	Tarrant	post 2000	N/A	80,000+
32	HVAC Renovation for Watauga Middle School	Tarrant	post 1992	23	1987 added
33	Renovations to HVAC System at Eisenhower Elementary	Dallas	post 1992	N/A	N/A
34	Renovations/Additions to Rayburn Elementary	Dallas	post 1992	N/A	38,000+
35	Renovations/Additions to Watauga Elementary School	Tarrant	post 1992	N/A	56,000+
36	Renovations/Additions to Smithfield Elementary School	Tarrant	post 1992	N/A	56,000+
37	Renovations to David E. Smith Elementary School	Tarrant	2003	30	45,000+
38	Renovations/Additions to Green Valley Elementary School	Tarrant	post 2000	8	50,000+
39	Renovations/Additions to Richland Elementary School	Tarrant	post 1992	221	38,000+
40	Renovations/Additions to Birdville Elementary School	Tarrant	post 1992	N/A	32,000+
41	Renovations/Additions to Grace Hardeman Elementary	Tarrant	post 2000	12	N/A
42	W.A. Porter Elementary School	Tarrant	post 2000	N/A	48,000+
43	Renovations/Additions to W.A. Porter Elementary School	Tarrant	post 2000	12	1963 added
44	Haltom Middle School	Tarrant	post 1992	N/A	109,000
45	HVAC Renovation for Haltom Middle School	Tarrant	post 2000	22	6730 added
46	HVAC Renovation for Richland Middle School`	Tarrant	post 1992	N/A	91,000
47	HVAC Renovation for North Oaks Middle School	Tarrant	post 1992	N/A	70,000
48	HVAC Renovation for North Richland Middle School	Tarrant	post 1992	N/A	75,000
49	Holiday Heights Elementary	Tarrant	post 2000	N/A	40,000
50	HVAC Renovation for Holiday Heights Elementary	Tarrant	post 2000	12	2923 added
51	HVAC Renovation for Watuaga Elementary	Tarrant	post 1992	N/A	40,000
52	HVAC Renovation for David E. Smith Elementary	Tarrant	post 1992	N/A	35,000

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
53	HVAC Renovation for West Birdville Elementary	Tarrant	post 1992	N/A	42,000
54	HVAC Renovation for Glenview Elementary	Tarrant	post 1992	N/A	40,000
55	HVAC Renovation for South Birdville Elementary	Tarrant	post 1992	149	38,000
56	HVAC Renovation for WT Francisco Elementary	Tarrant	post 2000	26	31,000
57	HVAC Renovation for Foster Village Elementary	Tarrant	post 2000	12	66,000
58	Snow Heights Elementary	Tarrant	post 2000	124	33,000
59	Renovations/Additions to Snow Heights Elementary School	Tarrant	post 2000	8	1963 added
60	HVAC Renovation for OH Stowe Elementary	Tarrant	post 1992	N/A	40,000
61	Jackson Middle School	Dallas	post 2000	365	100,000+
62	Renovations to HVAC System at Jackson Middle School	Dallas	post 2000	N/A	N/A
63	Renovations/Additions to Richland Elementary School	Tarrant	post 1992	N/A	38,000+
64	Renovations/Additions to Birdville Elementary School	Tarrant	post 1992	N/A	32,000+
65	HVAC Renovation for Rayburn Elementary School	Dallas	post 1992	N/A	N/A
66	HVAC Renovation for North Oaks Middle School	Tarrant	post 1992	204	70,000
67	HVAC Renovation for Watuaga Elementary	Tarrant	post 2000	26	40,000
68	Anchor Church	Tarrant	post 1992	N/A	40,000+
69	Little Elm Elementary	Denton	post 2001	218	70,000+
70	Griffen Parc Middle School	Collin	2004	383	151,566
71	Riddle Elementary	Collin	2003	238	70,000+
72	Boals Elementary	Collin	2003	238	74,300
73	Lake Dallas Middle School	Denton	post 2003	537.5	250,000+
74	North Elementary	Tarrant	post 1992	N/A	110,000+
75	Isbell Elementary	Collin	2004	279	75,904
76	Bledsoe Elementary	Collin	2005	279	75,904
77	Roach Middle School	Collin	post 1992	N/A	120,000+
78	Fowler Middle School	Collin	2006	488	138,651

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
79	North Star Elementary	Tarrant	post 1992	N/A	70,000+
80	Hometown Elementary School	Tarrant	post 1992	N/A	70,000+
81	Liberty High School	Collin	2007	1051	306,179
82	Ashley Elementary	Collin	2005	279	75,325
83	Ogle Elementary	Collin	2006	279	75,904
84	Sem Elementary	Collin	post 1992	N/A	70,000+
85	Corbell Elementary	Collin	2005	279	76,814
86	Taylor Elementary	Collin	post 1992	N/A	70,000+
87	Middle School #5	Tarrant	post 1992	N/A	1,40,000+
88	Intermediate School #5	Tarrant	post 1992	N/A	1,20,000+
89	Liberty Elementary	Tarrant	post 1992	N/A	70,000+
90	Stafford Middle School	Collin	2008	509	142,108
91	Scoggins Middle School	Collin	2008	512	124,108
92	Elementary #10	Tarrant	post 1992	N/A	70,000+
93	Elementary #11	Tarrant	post 1992	N/A	70,000+
94	Elementary #12	Tarrant	post 1992	N/A	70,000+
95	Elementary #13	Tarrant	post 1992	N/A	70,000+
96	Middle School #4	Tarrant	2006	624	151,417
97	Robertson Elementary	Collin	2007	291	75,902
98	Mooneyham Elementary	Collin	2007	291	75,902
99	Carrol Elementary	Collin	2007	291.5	75,902
100	Brookstone Elementary	Collin	2008	291.5	75,902
101	Tadlock Elementary	Collin	2008	306.5	77,184
102	Aubrey Intermediate/Middle School	Denton	post 2004	209.5	80,000+
103	Florence Hill Elementary	Dallas	post 2003	160	70,000+
104	Garner Elementary	Dallas	post 2004	160	70,000+

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
105	Bowie Elementary	Dallas	post 2004	44	25,000+
106	High School #5	Collin	post 1992	N/A	300,000+
107	High School #6	Collin	post 1992	N/A	300,000+
108	Memorial Stadium Field House	Collin	2004	27	10,000+
109	Rogers Elementary	Collin	post 2006	221	63,000+
110	Camp Wisdom Elementary	Dallas	post 1992	N/A	70,000+
111	Additions to Anderson Elementary	Collin	2003	30	9,000+
112	Additions to Borchardt Elementary	Collin	post 1992	N/A	9,000+
113	Bright Elementary	Collin	2004	30	9,000+
114	Additions to Christi Elementary	Collin	2004	29.5	9,000+
115	Additions to Curtsinger Elementary	Collin	post 1992	N/A	9,000+
116	Additions to Fisher Elementary	Collin	2003	30	9,000+
117	Additions to Shawnee Trail Elementary	Collin	post 1992	N/A	9000 +
118	CATE Center (Career and Technology)	Collin	2008	401.5	100, 000+
119	CTE at Centennial High School (Career and Technology)	Collin	2007	16	9000+
120	Staley Middle School Field House	Collin	2004	12	6000+
121	West Transportation Facility	Collin	2008	80	26,148
122	McKinney Lofts	Dallas	N/A	N/A	N/A
123	Havana Club Apartments	Bexar	N/A	N/A	N/A
124	Hogg Palace Lofts	Harris	N/A	N/A	N/A
125	South Main Baptist Church	Harris	N/A	N/A	N/A
126	The Tower	Tarrant	N/A	N/A	N/A
127	Edgemere	Dallas	N/A	N/A	N/A
128	Radisson Carlson Park	Bexar	N/A	N/A	N/A
129	Biggs Field Project	El Paso	N/A	N/A	N/A
130	Denison Housing Authority	Grayson	N/A	N/A	N/A
131	Fort Sam Houston Barracks	Bexar	N/A	N/A	N/A

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
132	Fort Sam Houston Building 905/906	Bexar	N/A	N/A	N/A
133	Fort Walters	Palo pinto	N/A	N/A	N/A
134	Drury Inn & Suites	Bexar	N/A	N/A	N/A
135	Lexington Hotel Suites	Tarrant	N/A	N/A	N/A
136	Arnold Middle School	Dallas	N/A	N/A	N/A
137	Shaner Hotel	Bexar	N/A	N/A	N/A
138	Holiday Inn Northwest	Bexar	N/A	N/A	N/A
139	2ND Home Suites	Dallas	N/A	N/A	N/A
140	Homewood Suites	Bexar	N/A	N/A	N/A
141	Air Dynamics	Dallas	N/A	N/A	N/A
142	Radiatas	Webb	N/A	N/A	N/A
143	Hensley Field Operations Center	Dallas	N/A	N/A	N/A
144	Southwest Plaza Base Bldg	Dallas	N/A	N/A	N/A
145	Air Performance	Dallas	N/A	N/A	N/A
146	Meadwest VA Co.	Harris	N/A	N/A	N/A
147	Gap #1550 Mockingbird Station	Dallas	N/A	N/A	N/A
148	Kirby Building	Dallas	N/A	N/A	N/A
149	USSA Towers	Bexar	N/A	N/A	N/A
150	Trinity Towers	Nueces	N/A	N/A	N/A
151	Sonny Bryans BBQ	Dallas	N/A	N/A	N/A
152	L'Etoile Restaurant	Bexar	N/A	N/A	N/A
153	Sweeny Ind.Sch. Dist.Warehouse	Brazoria	N/A	N/A	N/A
154	Freylands Elementary	Chambers	N/A	N/A	N/A
155	Mustang Mech. Montwood High	El Paso	N/A	N/A	N/A
156	Boerne Elementary School	Kendall	N/A	N/A	N/A
157	City View Schools	Wichita	N/A	N/A	N/A
158	Montwood High School Addition	El Paso	N/A	N/A	N/A

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
159	Montwood High School Auditorium	El Paso	N/A	N/A	N/A
160	The Island on Lake Travis	Travis	N/A	N/A	N/A
161	Allen Campus	Brazos	N/A	N/A	N/A
162	Judson Lofts	Bexar	N/A	N/A	N/A
163	pink elemtary school	collin	2005	286	75,904
164	Griffin middle school	collin	2002	N/A	N/A
165	Joslin Elementary	Travis	1991	N/A	N/A
166	Brent wood Elementary	Travis	1991	N/A	N/A
167	Walnut Creek Elementary	Travis	1991	N/A	N/A
168	Sims Elementary	Travis	1991	N/A	N/A
169	F R Rice Elementary	Travis	1991	N/A	N/A
170	T A Brown Elementary	Travis	1991	N/A	N/A
171	Canyon Ridge Middle School	William	2004	N/A	N/A
172	Vista Ridge High School	William	2004	N/A	N/A
173	Pleasant Hill Elemtary	William	2005	N/A	N/A
174	Good Night Middle school	Hays	1985	N/A	N/A
175	Santa Teresa Elementary	Hays	N/A	125	N/A
176	Santa Teresa Middle School	Hays	N/A	200	N/A
177	Esconreras primary kindergarten	Hays	N/A	105	N/A
178	Mullendore Elementary	Tarrant	post 1995	N/A	N/A
179	O.H. Stowe Elementary	Tarrant	post 1995	N/A	N/A
180	Austin Elementary School GPISD	Dallas	post 2000	91	atleast 21,100
181	Fannin Elementary School GPISD	Dallas	2004	220.5	N/A
182	Peaster Elementary	Parker	post 1995	N/A	N/A
183	Frisco Elementary School #15	collin	post 1995	N/A	N/A
184	Lone Star Elementary - Frisco ISD	collin	post 1995	N/A	N/A
185	Woodland Springs Elementary - Keller ISD	Tarrant	post 1995	N/A	N/A

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
186	Bette Perot Elementary - Keller ISD	Tarrant	post 1995	N/A	N/A
187	Granbury Middle School East Site	Hood	post 1995	N/A	N/A
188	Frisco Elementary #18 - Shaddock	collin	post 2007	N/A	N/A
189	Shiver Road Elementary #18 Keller ISD	Tarrant	post 2007	N/A	N/A
190	Woodland Springs Elementary #17 Keller ISD	Tarrant	post 2007	N/A	N/A
191	McDonwell Elementary (Keller ISD)	Tarrant	post 2007	N/A	N/A
192	Keller Intermediate School #5 Keller ISD	Tarrant	post 2007	N/A	N/A
193	Shady Shores Elementary	Denton	post 2007	392.75	75,904
194	Alta Vista Middle School #5 Keller ISD	Tarrant	post 2007	N/A	N/A
195	Brewer High School (White Settlement ISD)	Tarrant	post 2007	N/A	N/A
196	Leaky High school	Gillespie	N/A	120	N/A
197	Canutillo High School	El Paso	N/A	1200	N/A
198	Lubbock Christian University	Lubbock	N/A	N/A	N/A
199	Rice University	Harris	N/A	N/A	N/A
200	brown building lofts	Travis	N/A	N/A	N/A
201	Wheeler county Court House	wheeler	N/A	N/A	N/A
202	Ballinger housing authority	runnels	N/A	N/A	N/A
203	Project under category miscellaneous cited by FHP	Travis	N/A	N/A	N/A
204	Foreman independent school district	Bowie	N/A	N/A	N/A
205	Timber Creek High School #4	Tarrant	post '2008	116.5	361,141
206	Ed Wilkie Middle School #5: Geothermal Design Services	Travis	post '2008	643	
207	William & Abbie Allen Elementary School	Collin	post '2008	339	83,960
208	Career & Technology Education Center	N/A	post '2008	799	247,880
209	Early Childhood School	Collin	post '2008	385	54,861
210	Burleson Elementary School #11	N/A	post '2008	283.5	
211	Killeen Police Headquarters: Geothermal Design	Bell	post '2008	208	88,663
212	Burleson High School #2	Tarrant	post '2008	2126	490,447

Table 6-8: Geothermal Heat Pump Energy Projects (cont.)

S.No	Project	County	Implementation Date	Capacity (ton)	Area (sqft)
213	Secondary Instructional Facility	Travis	post '2008	745	184,824
214	Lamar & Norma Hunt Middle School #10	Collin	post '2008	512	147,096
215	Elizabeth Cash Maus Middle School #11	Collin	post '2008	512	147,096
216	Robert Cobb Middle School #12	Collin	post '2008	512	147,096
217	New ES	Collin	post '2008	310	77,184
218	Aubrey High School	Denton	post '2008	225	N/A
219	DFW Airport: EAD Annex	Travis	post 2009	18	N/A
220	2009 Capital Improvements @ Various Campuses	Travis	post 2009	147.5	N/A
221	Pre-Kindergarten School	Denton	post 2009	164	60,391
222	George & Debra Purefoy Elementary School #30	N/A	post 2009	304	N/A
223	Elementary School #14: Geothermal Design Services	N/A	post 2009	Y	N/A
224	Patricia Dean Boswell McCall Elementary School	Parker	2007	367	89,642
225	Aubrey Intermediate:Add/Reno	Denton	2007	234	69,519
226	Sam Carter Service Center	Collin	2007	116	49,377
227	Dr. Monaco Elementary School	Denton	2007	263	74,544
228	Caprock Elementary School #20	Tarrant	2007	303.5	92,768
229	Trinity Springs Middle School: Add.	Tarrant	2007	120.5	36,136
230	Milam Elementary School: 2007 Bond HVAC Replacement	Dallas	2008	131	N/A
231	Truman Middle School: HVAC Retrofit Phase 2	Dallas	under progress	146	N/A
232	Alta Vista Elementary School	Tarrant	under progress	572.5	N/A
233	Sandshell Elementary School #21	Travis	under progress	278	N/A
234	Corinth Primary	Denton	under progress	238	N/A
235	All Saints Episcopal School	Travis	under progress	337	N/A
236	Alliance for Children	Travis	under progress	33	N/A
237	Faithbridge Presbyterian Church	Collin	under progress	165	N/A
238	Heritage High School	Collin	2007	1041.5	325,693
239	Cotulla High School	La Salle	N/A	N/A	N/A
240	Marlin Hospital	Falls	N/A	N/A	N/A
241	Stacy Park Pool	Travis	N/A	N/A	N/A
242	1505, elm street	Dallas	N/A	N/A	N/A
243	Covington high school	Hill	N/A	N/A	N/A

Table 6-9: Landfill Gas-Fired Power Plants: Operational

Project No	Landfill Name	City	County	Waste In Place (tons)	Landfill Owner Organization	Project Status	Project Start Date	MW Capacity	LFG Flow to Project (SCFD)	Emission Reductions (MTCO2)
1	McCarty Road LF	Houston	Harris	28,918,718	Allied Waste Services	Operational	1/1/1986	N/A	N/A	0.797
2	DFW Gas Recovery	Lewisville	Denton	N/A	WM Renewable Energy LLC	Operational	5/1/1988	3	N/A	N/A
3	DFW Gas Recovery	Lewisville	Denton	N/A	WM Renewable Energy LLC	Operational	5/1/1988	3	N/A	N/A
4	Dallas-Fort Worth LF	Dallas	Denton	18,388,100	Waste Management, Inc.	Operational	1/1/1992	6.6	N/A	0.286
5	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	12/1/1996	1	N/A	N/A
6	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	12/1/1996	1	N/A	N/A
7	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	12/1/1996	1	N/A	N/A
8	Sunset Farms	Austin	Travis	9,600,000	Allied Waste Services	Operational	12/1/1996	3	1.5	0.13
9	Austin Community LF	Austin	Travis	10,380,188	Waste Management, Inc.	Shutdown	1/1/1998	N/A	N/A	N/A
10	City of Brownwood Landfill	Brownwood	Brown	1,300,100	City of Brownwood	Operational	1/1/1998	N/A	N/A	0.035
11	McCommas Bluff LF/City of Dallas	Dallas	Dallas	26,470,000	City of Dallas, TX	Operational	1/1/2000	N/A	N/A	0.772
12	Rosenberg Landfill	Rosenberg	Fort Bend	2,649,100	Fort Bend County, TX	Operational	1/1/2000	N/A	1	0.082
13	Castle Road Landfill	Garland	Dallas	4,012,500	City of Garland	Operational	5/1/2000	N/A	N/A	0.089
14	Arlington LF	Arlington	Tarrant	13,981,144	City of Arlington	Operational	6/1/2001	5	1.584	0.217
15	BFI - Tessman Road Landfill	San Antonio	Bexar	11,300,000	Allied Waste Services	Operational	10/10/2002	5.4	2.9	0.234
16	Coastal Plains LF	Alvin	Galveston	6,546,410	Waste Management, Inc.	Operational	1/10/2003	6.7	N/A	0.289
17	Sanifill Of Texas-Baytown LF	Baytown	Chambers	6,290,000	Waste Management, Inc.	Operational	1/24/2003	3.9	1.73	0.169
18	Blue Bonnet LF	Houston	Harris	2,526,000	Waste Management, Inc.	Operational	3/1/2003	1.9	0.928	0.084
19	City of Conroe LF	Conroe	Montgomery	3,146,000	City of Conroe	Operational	3/1/2003	2.9	N/A	0.126
20	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
21	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
22	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3/2/2008	0.3	N/A	N/A
23	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
24	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
25	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
26	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
27	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A

Table 6-9: Landfill Gas-Fired Power Plants: Operational (cont.)

Project No	Landfill Name	City	County	Waste In Place (tons)	Landfill Owner Organization	Project Status	Project Start Date	MW Capacity	LFG Flow to Project (SCFD)	Emission Reductions (MTCO2)
28	Coastal Plains	Alvin	Galveston	N/A	Viridis Energy	Operational	3/3/2008	1.3	N/A	N/A
29	BFI - Tessman Road Landfill	San Antonio	Bexar	11,300,000	Allied Waste Services	Operational	5/1/2003	2.7	1.45	0.117
30	Security Recycling and Disposal LF	Cleveland	Montgomery	4,014,800	Waste Management, Inc.	Operational	5/1/2003	5	N/A	0.217
31	BFI Tessman Rd Landfill	San Antonio	Bexar	N/A	Energy Developments Inc	Operational	5/3/2008	1.4	N/A	N/A
32	WMI/Atascocita LF	Humble	Harris	9,628,700	Waste Management, Inc.	Operational	6/1/2003	8.5	3.09	0.368
33	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
34	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
35	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
36	Bluebonnet	Houston	Harris	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
37	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
38	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
39	Conroe	Conroe	Montgomery	N/A	Viridis Energy	Operational	8/3/2008	1	N/A	N/A
40	Baytown	Baytown	Chambers	N/A	Viridis Energy	Operational	12/3/2008	1.3	N/A	N/A
41	Baytown	Baytown	Chambers	N/A	Viridis Energy	Operational	12/3/2008	1.3	N/A	N/A
42	Security	Houston	Montgomery	N/A	Viridis Energy	Operational	12/3/2008	1.3	N/A	N/A
43	Security	Houston	Montgomery	N/A	Viridis Energy	Operational	12/3/2008	1.3	N/A	N/A
44	Baytown	Baytown	Chambers	N/A	Viridis Energy	Operational	12/3/2008	1.3	N/A	N/A
45	Sunset Farms	Austin	Travis	N/A	Gas Recovery Systems Inc	Operational	1/4/2008	1	N/A	N/A
46	WMI/Atascocita LF	Humble	Harris	9,628,700	Waste Management, Inc.	Operational	1/1/2004	1.7	0.62	0.074
47	City of Austin LF	Austin	Travis	4,858,500	City of Austin, TX	Operational	2/1/2004	0.2	N/A	0.009
48	City of Waco LF	Woodway	McLennan	2,225,000	City of Waco	Operational	3/1/2004	1.5	1	0.065
49	Atascosita	Atascosita	Harris	N/A	Viridis Energy	Operational	7/4/2008	1.7	N/A	N/A
50	Denton Sanitary Landfill	Denton	Denton	2,266,664	City of Denton, TX	Operational	2/1/2005	N/A	0.432	0.035
51	Covel Gardens LF	San Antonio	Bexar	12,007,000	Waste Management, Inc.	Operational	12/1/2005	9.6	N/A	0.416
52	Fort Worth Regional LF	Haltom City	Tarrant	N/A	Allied Waste Services	Construction	3/15/2006	1.6	0.72	0.069
53	McCommas Bluff LF/City of Dallas	Dallas	Dallas	26,470,000	City of Dallas, TX	Construction	7/1/2006	22	N/A	0.953
54	Denton Sanitary Landfill	Denton	Denton	2,266,664	City of Denton, TX	Construction	9/1/2006	1.5	0.86	0.065

Table 6-10: Landfill Gas-Fired Power Plants: Candidates

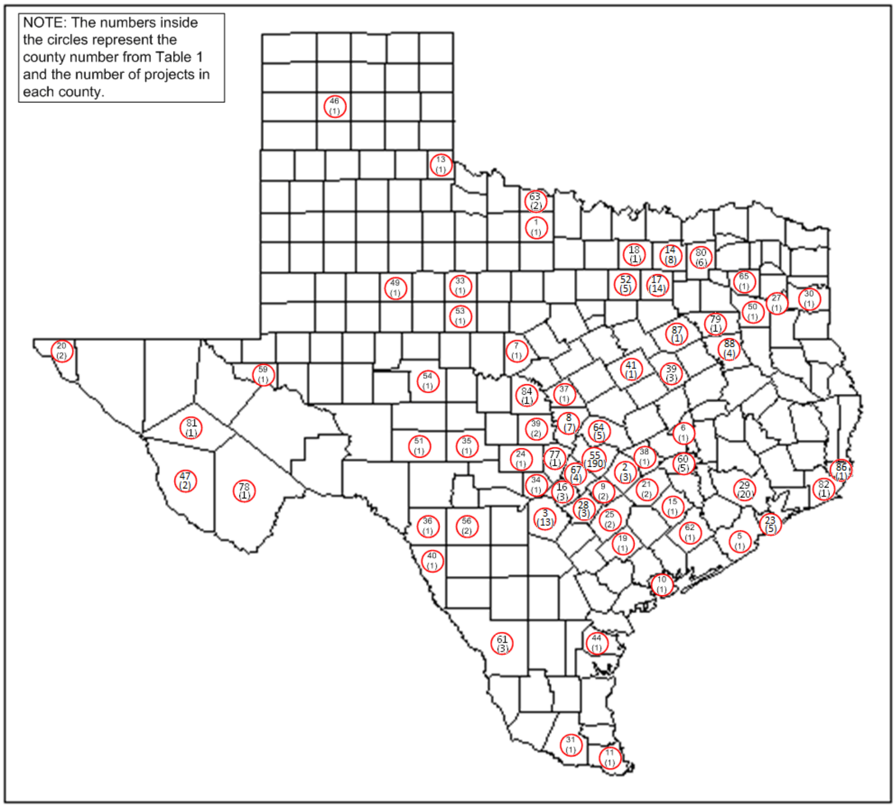
Project.No	Landfill Name	County	Waste In Place (tons)	Year Landfill Opened	Landfill Closure Year	Landfill Owner Organization
1	Skyline LF	Ellis	8,191,000	1942	2040	Waste Management, Inc.
2	Trinity Oaks Landfill	Dallas	6,838,600	1969	2003	Allied Waste Services
3	J.C. Elliot LF	Nueces	5,717,100	1972	2005	City of Corpus Christi, TX
4	Galveston County LF	Galveston	7,822,500	1973	2025	Allied Waste Services
5	Mill Creek LF	Tarrant	4,815,500	1973	2002	Allied Waste Services
6	City of Lubbock LF	Lubbock	2,177,800	1975	2008	City of Lubbock
7	City of Pampa LF	Gray	1,176,200	1975	2007	City of Pampa
8	Colorado City Landfill	Mitchell	1,545,200	1975	2020	City of Colorado City
9	Comal County LF	Comal	3,817,620	1975	2010	Waste Management, Inc.
10	Amarillo LF	Potter	7,031,400	1976	2050	City of Amarillo
11	C&T Landfill	Hidalgo	3,844,000	1976	2004	Duncan Disposal, Inc.
12	City Of Sweetwater LF	Nolan	1,283,800	1976	2040	City of Sweetwater
13	City Of Weatherford LF	Parker	1,079,000	1976	2060	IESI, Inc.
14	Fort Worth Southeast Landfill	Tarrant	5,299,400	1976	2036	City of Fort Worth, TX
15	Tricil Environmental Response/Altar SLF	Colorado	1,980,400	1976	2002	Safety Clean
16	Austin Community LF	Travis	10,380,188	1977	2001	Waste Management, Inc.
17	City of Grand Prairie LF	Dallas	2,835,800	1977	2021	City of Grand Prairie
18	City of Nacogdoches Landfill	Nacogdoches	1,296,200	1977	2033	City of Nacogdoches
19	Westside Sanitary LF	Tarrant	9,955,600	1977	2005	Waste Management, Inc.
20	Whispering Pines LF	Harris	6,405,000	1978	2017	Allied Waste Services
21	City of Perryton Landfill	Ochiltree	1,631,100	1979	2006	City of Perryton
22	City of McKinney LF	Collin	3,957,000	1980	2004	City of McKinney
23	Nelson Gardens LF	Bexar	11,800,000	1980	1993	City of San Antonio
24	Camelot Landfill	Denton	6,044,700	1981	2019	City of Farmers Branch
25	City of Irving Landfill	Dallas	2,063,900	1981	2065	City of Irving, TX
26	Hillside Landfill	Grayson	2,526,400	1981	2023	Waste Management, Inc.
27	Sprint Fort Bend County LF	Fort Bend	1,664,372	1981	2020	The Sprint Companies

Table 6-10: Landfill Gas-Fired Power Plants: Candidates (cont.)

Project.No	Landfill Name	County	Waste In Place (tons)	Year Landfill Opened	Landfill Closure Year	Landfill Owner Organization
28	Williamson County LF	Williamson	2,134,700	1981	2040	Waste Management, Inc.
29	BFI - Abilene Landfill	Jones	7,921,300	1982	2067	Ray Knowles
30	City of Victoria Landfill	Victoria	2,556,000	1982	2040	City of Victoria
31	City of Wichita Falls LF	Wichita	4,073,200	1982	2021	City of Wichita Falls
32	North Texas Waste/Maxwell Creek LF	Collin	6,083,700	1982	2004	North Texas Municipal Water
33	Pine Hill LF	Gregg	12,141,700	1982	2060	4S Oil Company
34	City of Beaumont LF	Jefferson	2,868,800	1983	2021	City of Beaumont
35	Clint LF	El Paso	4,904,400	1983	2006	City of El Paso
36	Royal Oaks Landfill	Cherokee	1,044,200	1983	2030	Allied Waste Services
37	Turkey Creek LF	Johnson	3,733,200	1983	2025	Allied Waste Services
38	McCombs LF	El Paso	4,137,100	1984	2046	City of El Paso
39	CSC Disposal and Landfill	Ellis	4,254,250	1985	2100	Republic Services, Inc.
40	Lacy-Lakeview LF	McLennan	1,306,200	1985	2020	Waste Management, Inc.
41	City of Laredo LF	Webb	3,180,000	1986	2015	City of Laredo
42	City of Port Arthur Landfill	Jefferson	1,802,100	1986	2044	City of Port Arthur
43	Southwest Landfill (Amarillo)	Randall	3,393,200	1987	2025	Allied Waste Services
44	Sprint LF	Harris	2,041,600	1987	2005	Landfill Owner
45	Altair Disposal Services LLC	Colorado	9,195,000	1988	2004	Clean Harbors
46	Greenwood Farms Landfill	Smith	3,087,300	1989	2020	City of Tyler
47	Texas Disposal Systems LF	Travis	4,408,900	1990	2050	Texas Disposal Systems
48	Golden Triangle Landfill	Jefferson	2,310,400	1991	2021	Allied Waste Services
49	Blue Ridge LF	Fort Bend	4,113,900	1993	2025	Allied Waste Services
50	Brazoria County Disposal LF	Brazoria	6,279,700	1993	2050	Republic Services, Inc.
51	WMI/E & D Waste Systems Inc. LF	Galveston	3,202,900	1994	2022	Waste Management, Inc.
52	Charter Waste Landfill	Ector	1,300,000	N/A	N/A	Republic Services, Inc.
53	City of Temple Landfill	Bell	3,600,000	N/A	N/A	City of Temple
54	Eastside Landfill	Tarrant	N/A	N/A	N/A	Waste Management, Inc.

Table 6-11: Landfill Gas-Fired Power Plants: Potential

Project.No	Landfill Name	City	County	Waste In Place (tons)	Year Landfill Opened	Landfill Closure Year	Landfill Owner Organization
1	Pleasant Oaks Landfill	Mount Pleasant	Titus	N/A	1960	2012	City of Mount Pleasant
2	Sinton	Sinton	San Patricio	N/A	1972	2002	Allied Waste Services
3	City of Richardson LF	Richardson	Collin	825,218	1975	1990	City of Richardson
4	City of Cleburne Landfill	Cleburne	Johnson	1,583,200	1976	N/A	Landfill Owner
5	Itasca Landfill	Itasca	Hill	N/A	1977	2017	Allied Waste Services
6	Quail Canyon	Lubbock	Lubbock	200,200	1977	1993	Allied Waste Services
7	Hutchins Landfill	Hutchins	Dallas	1,000,000	1978	1992	Allied Waste Services
8	Maloy Landfill	Commerce	Hunt	610,000	1979	2030	Republic Services, Inc.
9	Mexia Landfill	Mexia	Limestone	N/A	1983	2019	Allied Waste Services
10	Pecan Prairie Landfill	Kingston	Hunt	1,479,900	1984	1998	Waste Management, Inc.
11	Trashaway San Angelo Landfill	San Angelo	Tom Green	790,000	1984	N/A	Republic Services, Inc.
12	Kerrville Landfill	Kerrville	Kerr	N/A	1985	2006	City of Kerrville
13	Lewisville Landfill	Lewisville	Denton	N/A	1986	2003	Allied Waste Services
14	ECD Landfill	Ennis	Ellis	N/A	1988	2089	Allied Waste Services
15	Bell Processing Inc. LF	Wichita Falls	Wichita	N/A	1990	2001	Bell Processing Inc
16	Laidlaw/Wilmer LF	Wilmer	Dallas	686,400	1992	2001	Landfill Owner
17	BFI LF	Abilene	Taylor	745,888	1993	1997	Pine Street Salvage Company
18	City of Corsicana LF	Corsicana	Navarro	788,100	1993	2100	Landfill Owner
19	Gulfwest Facility	Anahuac	Chambers	N/A	1993	2017	Allied Waste Services
20	Bell County/Sparks LF	Belton	Bell	343,200	1994	2001	Bell County
21	Ellis County LF	Palmer	Ellis	892,320	1994	N/A	Waste Management, Inc.
22	El Centro Landfill	Robstown	Nueces	N/A	2000	2013	Allied Waste Services
23	Best Pak Disposal Inc. LF	Pattison	Waller	N/A	N/A	2001	Waste Management, Inc.
24	Hazelwood Enterprises, Inc. LF	N/A	N/A	N/A	N/A	N/A	Landfill Owner
25	New Boston Landfill	New Boston	Bowie	N/A	N/A	N/A	N/A
26	Newton County Landfill	Mauriceville	Newton	N/A	N/A	N/A	N/A
27	North County C&D Landfill	League City	Galveston	N/A	N/A	N/A	Republic Services, Inc.
28	Paris Landfill	Paris	Lamar	N/A	N/A	N/A	N/A
29	Rio Grande Valley	Donna	Hidalgo	N/A	N/A	N/A	Allied Waste Services



Legend

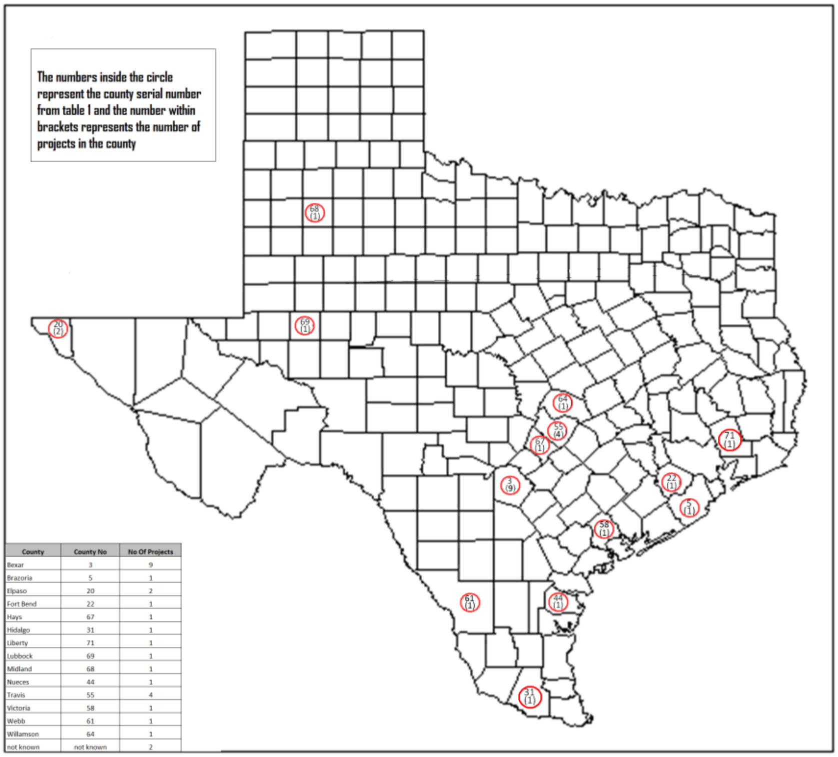
County	County No	Projects
Anderson	88	4
Archer	1	1
Bastrop	2	3
Bexar	3	13
Blanco	77	1
Brazoria	5	1
Brazos	6	1
Brewster	78	1
Brown	7	1
Burnet	8	7
Caldwell	9	2
Calhoun	10	1
Cameron	11	1
Childress	13	1
collin	14	8
Colorado	15	1
Comal	16	3

County	County No	No Of Projects
Dallas	17	14
Denton	18	1
DeWitt	19	1
El Paso	20	2
Fayette	21	2
Galveston	23	5
Gillespie	24	1
Gonzales	25	2
Gregg	27	1
Guadalupe	28	3
Harris	29	20
Harrison	30	1
Hays	67	4
Henderson	79	1
Hidalgo	31	1
Hunt	80	6
Jeff Davis	81	1

County	County No	No Of Projects
Jefferson	82	1
Jones	33	1
Kendall	34	1
Kimble	35	1
Kinney	36	1
Lampasas	37	1
Lee	38	1
Limestone	39	1
Llano	39	3
Maverick	40	1
McLennan	41	1
Navarro	87	1
Nueces	44	1
Orange	86	1
Potter	46	1
Presidio	47	2
San Saba	84	1

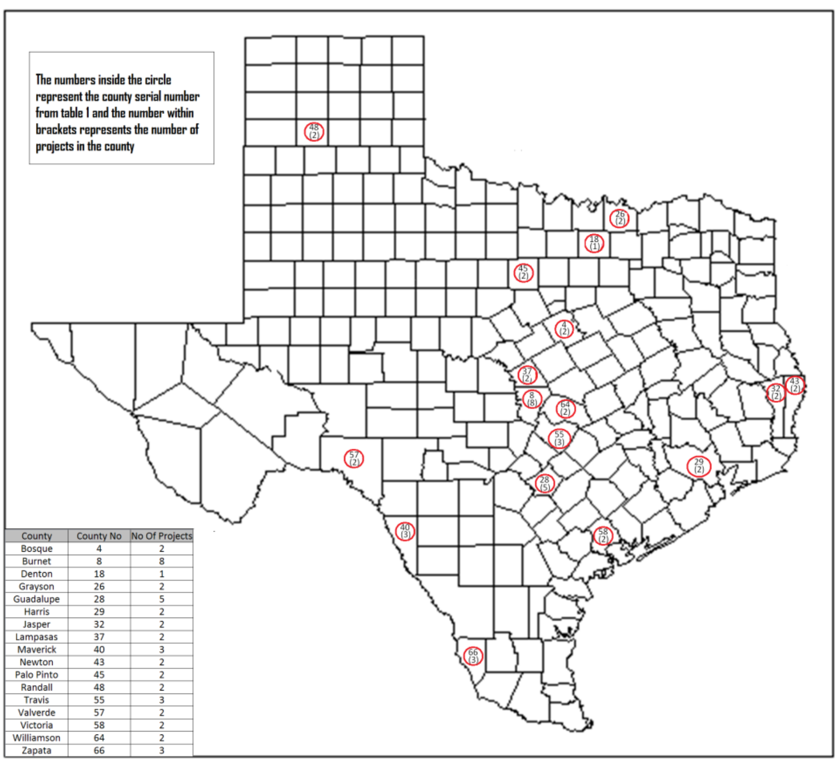
County	County No	No Of Projects
Scurry	49	1
Smith	50	1
Sutton	51	1
Tarrant	52	5
Taylor	53	1
Tom Green	54	1
Travis	55	190
Uvalde	56	2
Ward	59	1
Washington	60	5
Webb	61	3
Wharton	62	1
Wichita	63	2
Williamson	64	5
Wood	65	1

Figure 6-1: Solar Photovoltaic Projects throughout Texas



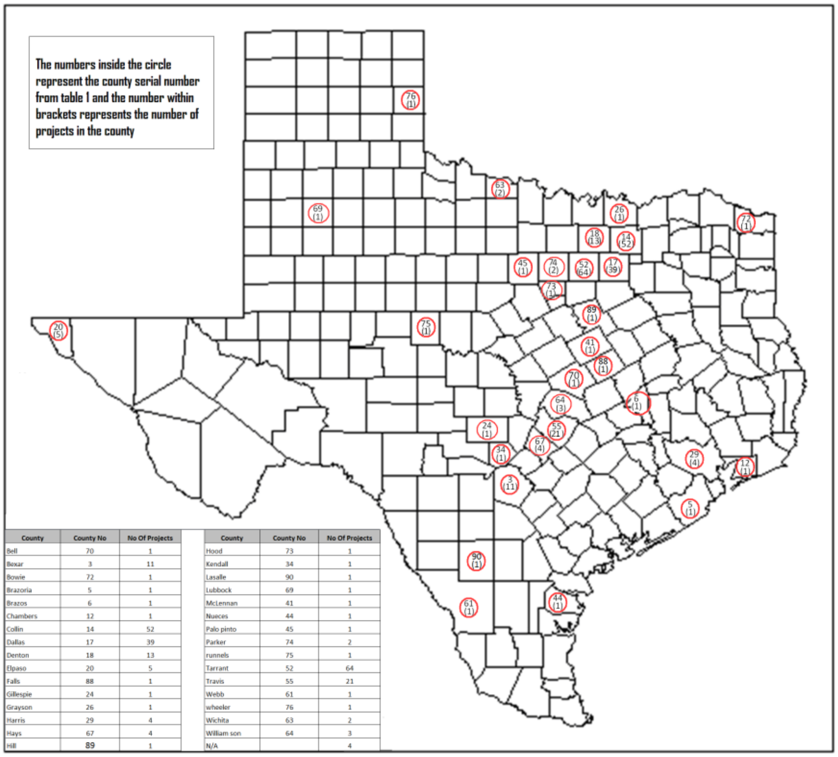
County	County No	No Of Projects
Bexar	3	9
Brazoria	5	1
Elpaso	20	2
Fort Bend	22	1
Hays	67	1
Hidalgo	31	1
Liberty	71	1
Lubbock	69	1
Midland	68	1
Nueces	44	1
Travis	55	4
Victoria	58	1
Webb	61	1
Willamson	64	1
not known	not known	2

Figure 6-2: Solar Thermal Projects throughout Texas



County	County No	No Of Projects
Bosque	4	2
Burnet	8	8
Denton	18	1
Grayson	26	2
Guadalupe	28	5
Harris	29	2
Jasper	32	2
Lampasas	37	2
Maverick	40	3
Newton	43	2
Palo Pinto	45	2
Randall	48	2
Travis	55	3
Valverde	57	2
Victoria	58	2
Williamson	64	2
Zapata	66	3

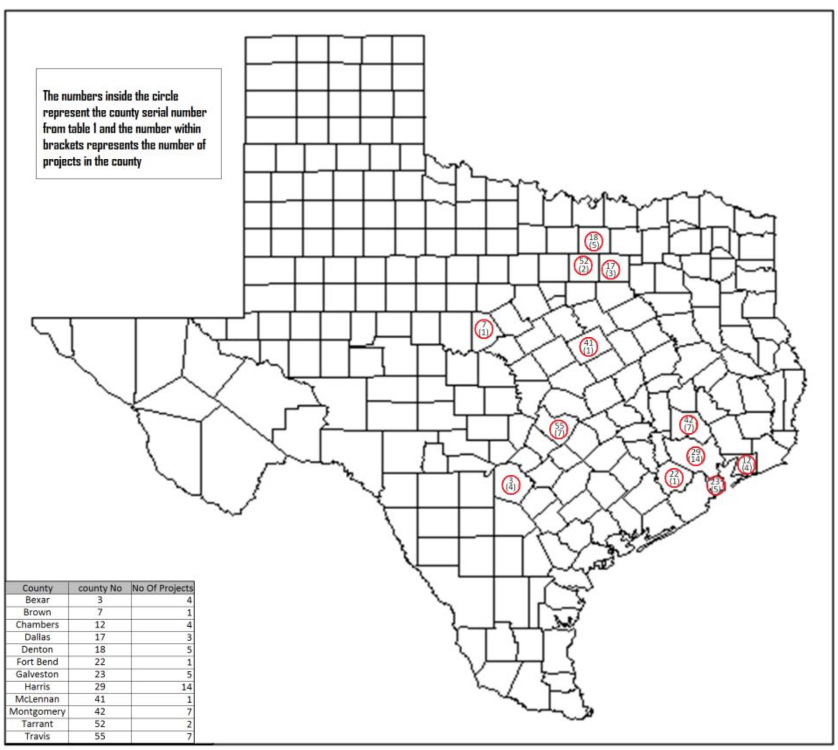
Figure 6-3: Hydropower Plants throughout Texas



County	County No	No Of Projects
Bell	70	1
Bexar	3	11
Bowie	72	1
Brazoria	5	1
Brazos	6	1
Chambers	12	1
Collin	14	52
Dallas	17	39
Denton	18	13
Elpaso	20	5
Falls	88	1
Gillespie	24	1
Grayson	26	1
Harris	29	4
Hays	67	4
Hill	89	1

County	County No	No Of Projects
Hood	73	1
Kendall	34	1
Lasalle	90	1
Lubbock	69	1
McLennan	41	1
Nueces	44	1
Palo pinto	45	1
Parker	74	2
runnels	75	1
Tarrant	52	64
Travis	55	21
Webb	61	1
wheeler	76	1
Wichita	63	2
William son	64	3
N/A		4

Figure 6-4: Geothermal Projects Installed throughout Texas



County	county No	No Of Projects
Bexar	3	4
Brown	7	1
Chambers	12	4
Dallas	17	3
Denton	18	5
Fort Bend	22	1
Galveston	23	5
Harris	29	14
McLennan	41	1
Montgomery	42	7
Tarrant	52	2
Travis	55	7

Figure 6-5: Landfill Gas-Fired Power Projects Installed throughout Texas

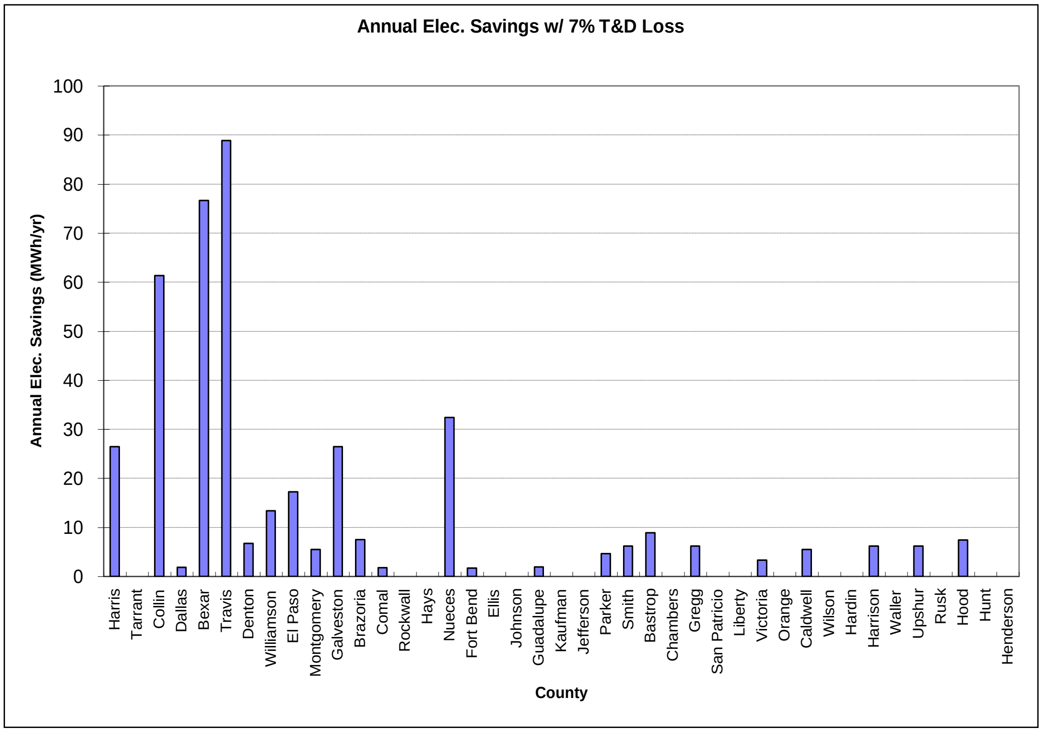


Figure 6-6: Annual Electric Savings per County from PV Projects

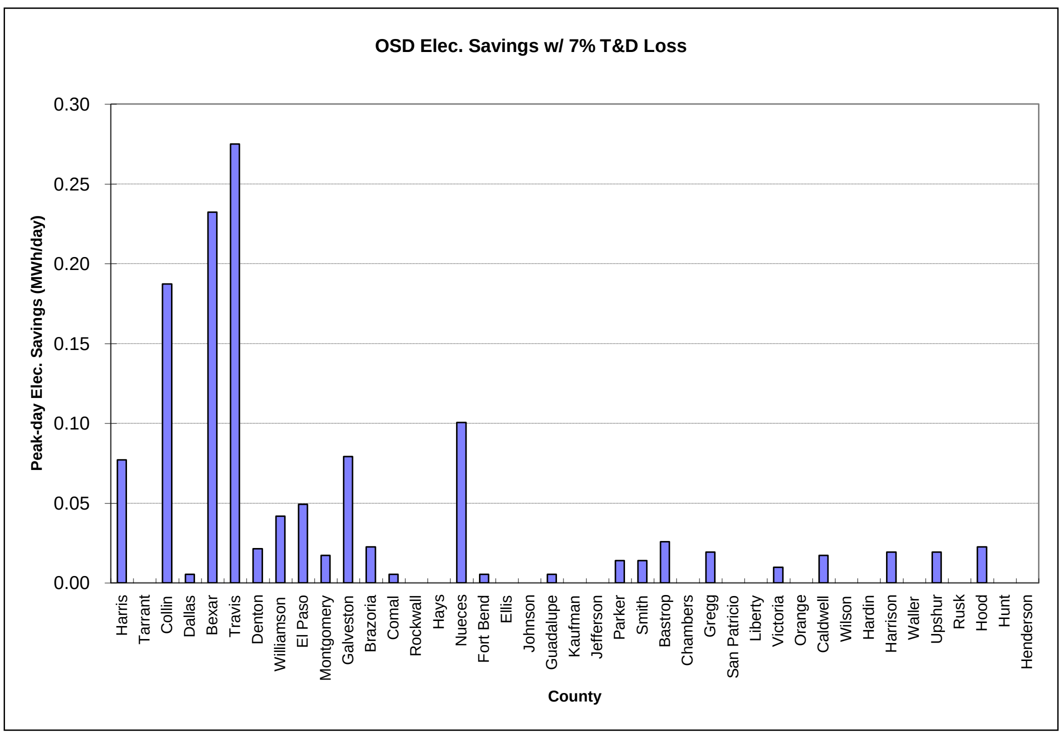


Figure 6-7: Ozone Season Day Electric Savings per County from PV Projects

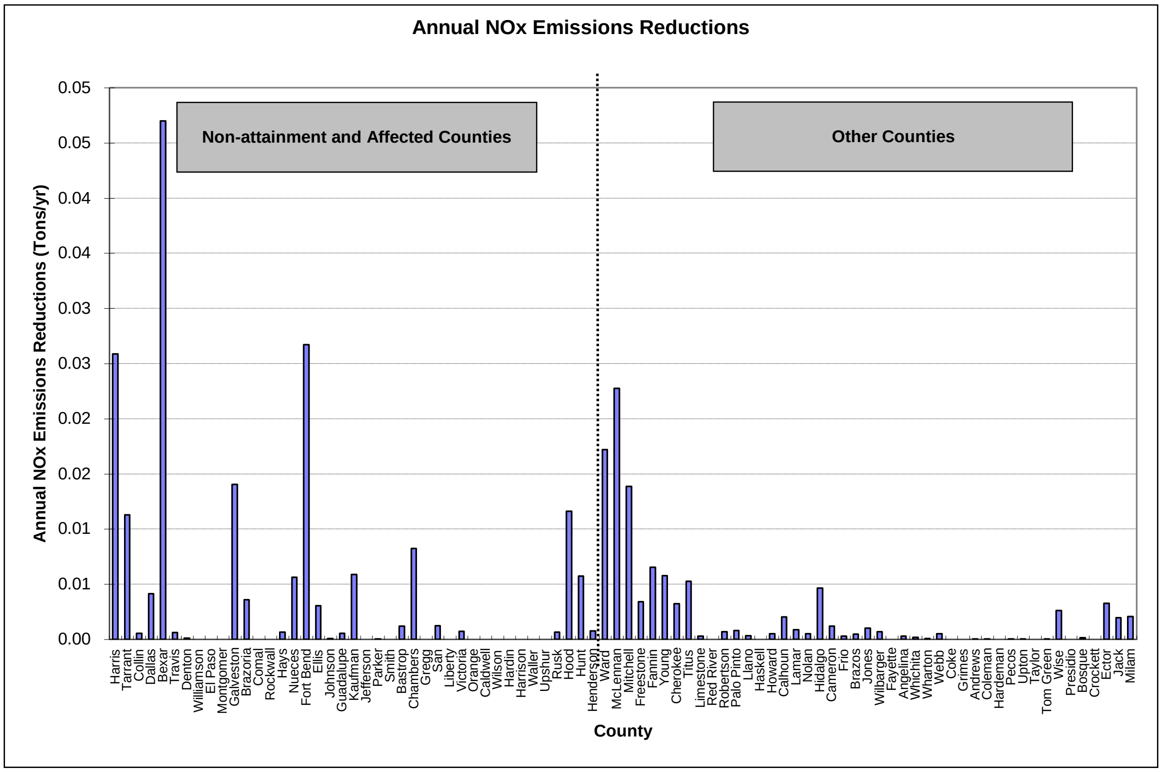


Figure 6-8: NOx Emissions Reductions per County from PV Projects

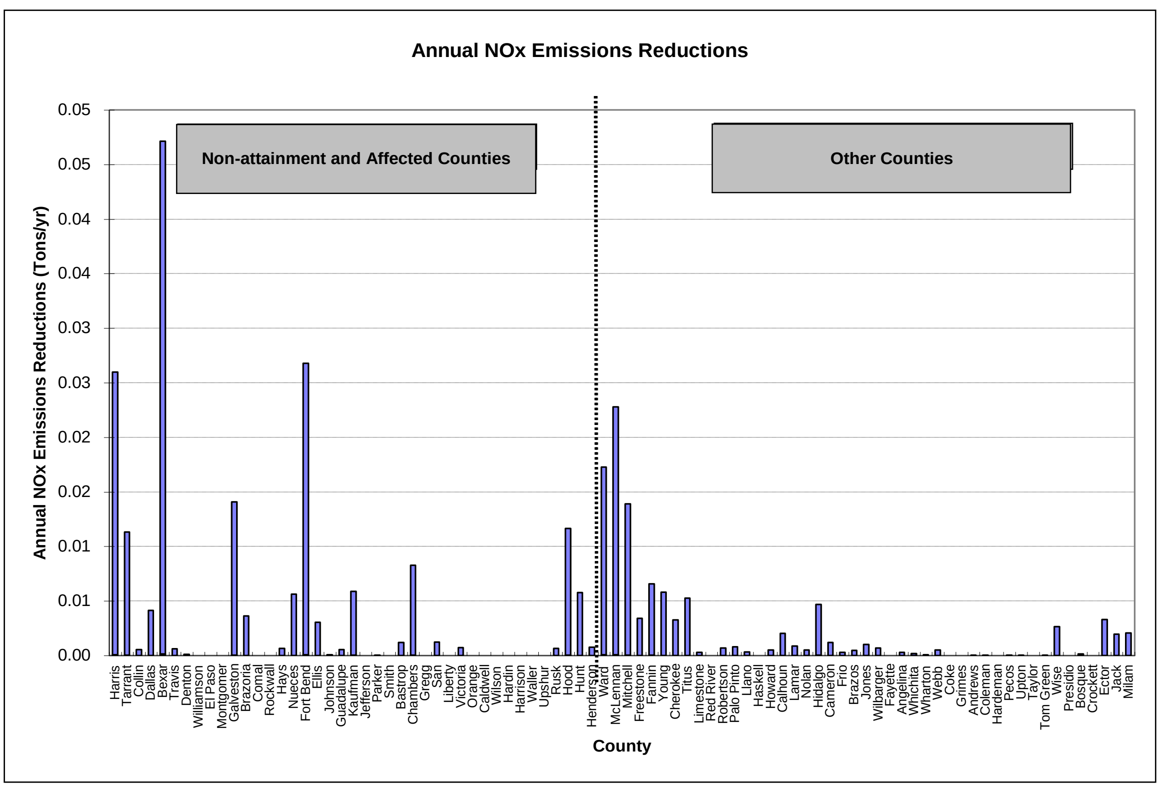


Figure 6-9: Ozone Season Day NOx Emissions Reductions per County from PV Projects

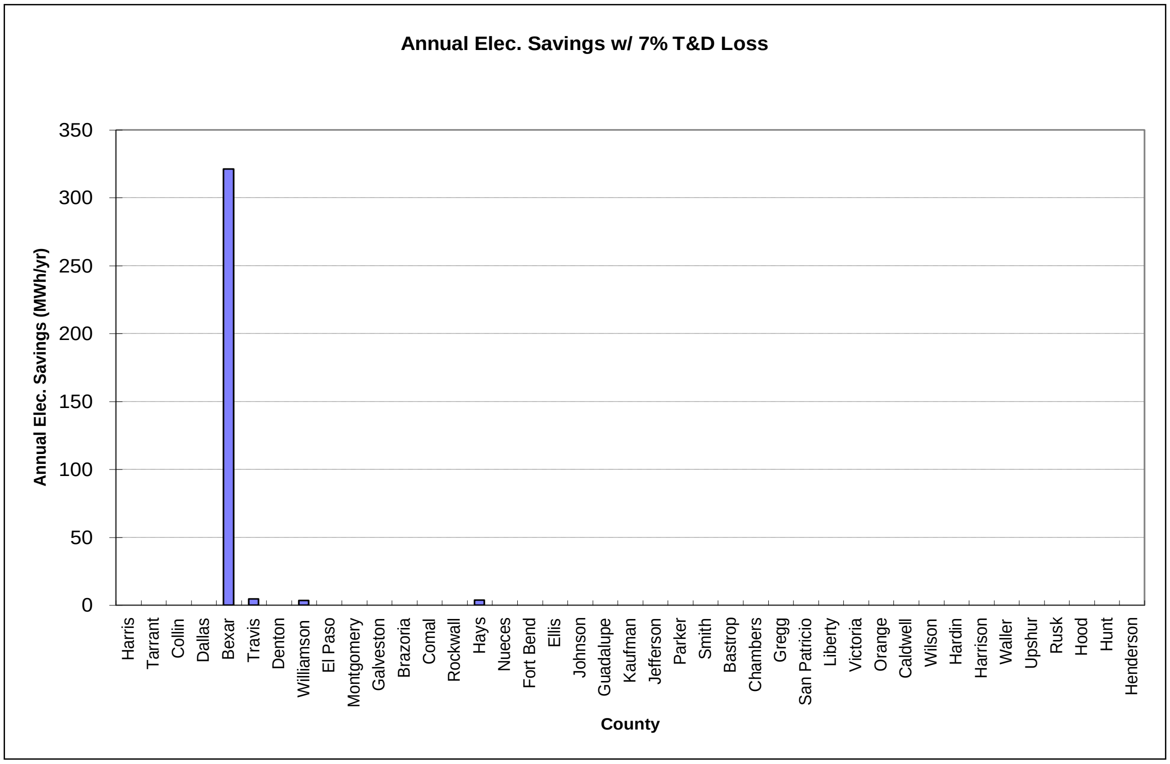


Figure 6-10: Annual Electric Savings per County from Solar Thermal Projects

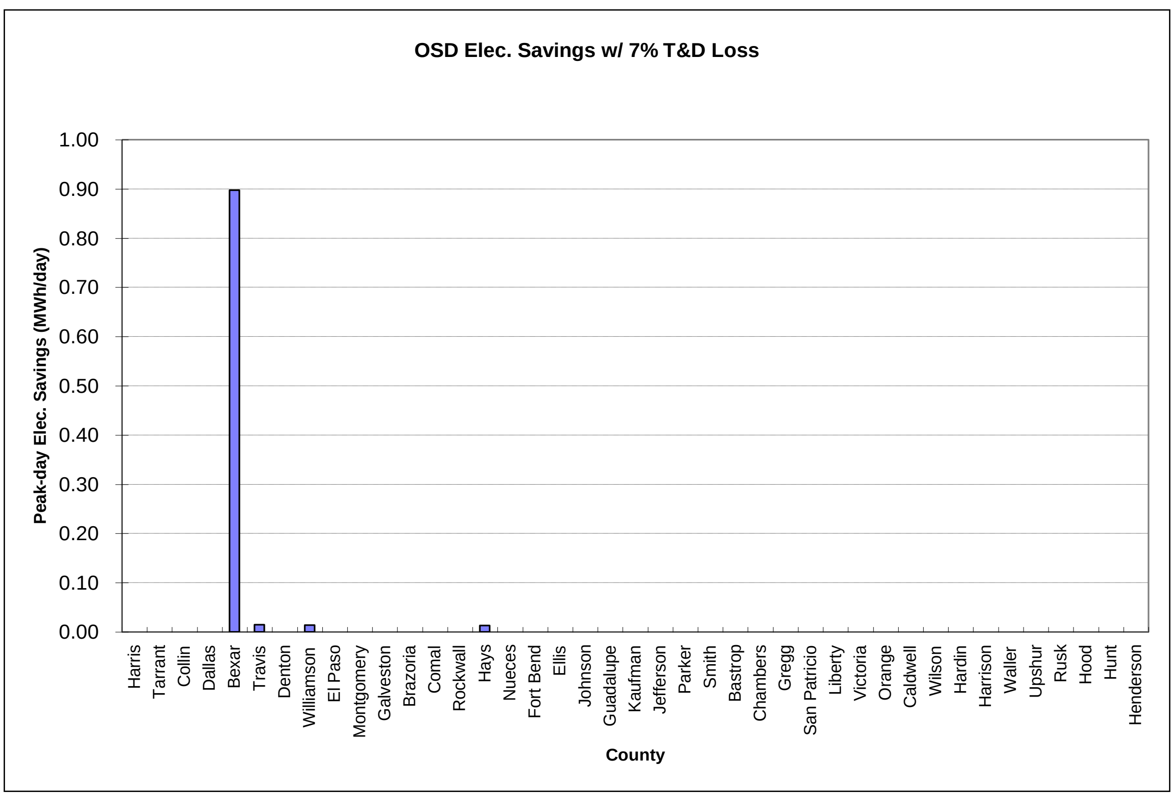


Figure 6-11: Ozone Season Day Electric Savings per County from Solar Thermal Projects

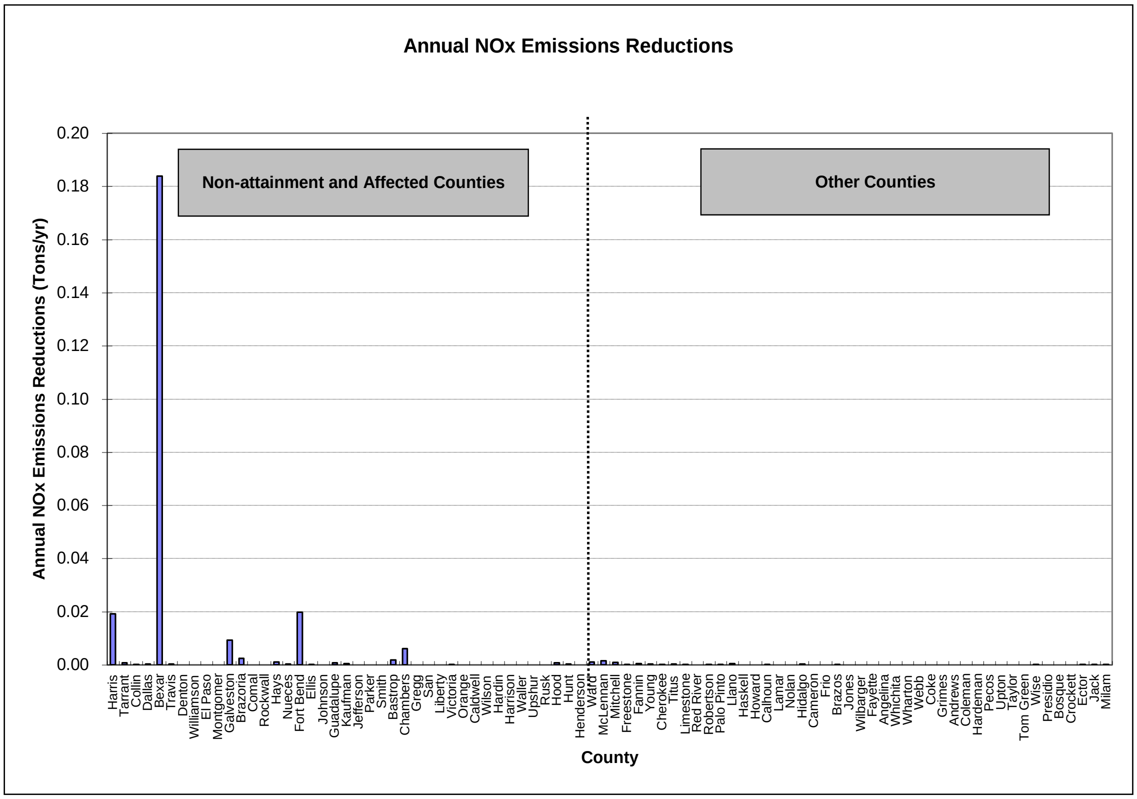


Figure 6-12: NOx Emissions Reductions per County from Solar Thermal Projects

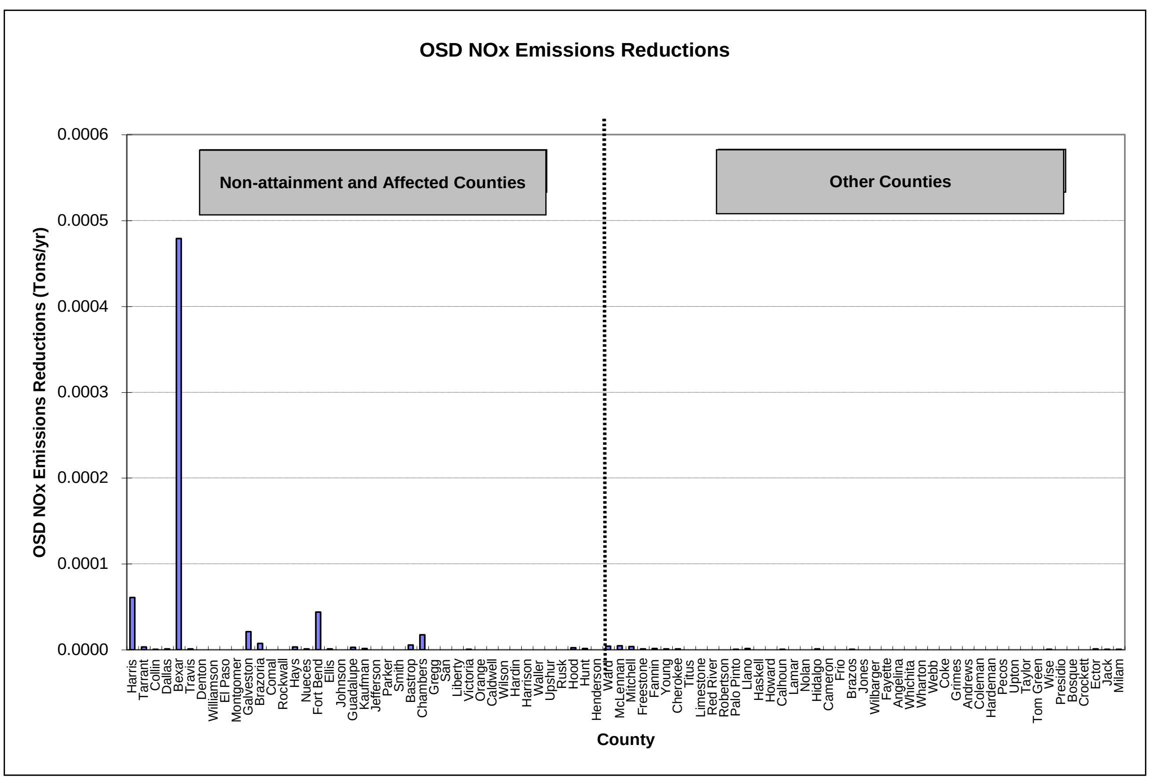


Figure 6-13: Ozone Season Day NOx Emissions Reduction per County from Solar Thermal Projects

7 REVIEW OF ERCOT'S RENEWABLE ENERGY CREDIT PROGRAM INFORMATION

7.1 Introduction

In this section, the information posted on ERCOT's Renewable Energy Credit Program site www.texasrenewables.com was reviewed for use in the Laboratory's report to the TCEQ. In particular, information posted under the "Public Reports" tab was downloaded and assembled into an appropriate format for review. This includes ERCOT's 2001 through 2009 reports to the Legislature, which were converted into tabular format for analysis and insertion into this report. Similarly, information from ERCOT's listing of REC generators was inspected to determine how it compared with other sources of information the Laboratory has assembled.

7.2 Summary of Renewable Projects in Texas

Each year ERCOT is required to compile a list of grid-connected sources that generate electricity from renewable energy and report to the Legislature. Table 7-2and Table 7-3 contain the data reported by ERCOT from 2001 through 2009.Figure 7-1, Figure 7-2 and Figure 7-3 have been included to better illustrate the annual data collected by ERCOT. In the figures and tables it is clear to see that the electricity generated by wind each year is the largest single source of renewable energy in Texas, which has grown from 565,597 MWh in 2001 to 20,595,989 MWh in 2009. This is followed by landfill gas, which has grown from 29,412 MWh in 2002 to 412,926 MWh in 2009, hydroelectric: 30,639 (2001) to 507,507 (2009), biomass: 39,496 MWh (2003) to 73,364 MWh in 2009 with and lastly solar: 87 MWh (2002) to 4492 MWh (2009).

Table 7-1: ERCOT REC Generator List

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
El Paso Electric Company	El Paso Electric	EPE	Hueco Mountain Wind Ranch	EPE1	1	Monica Garcia	Wind	23631
FPL Pecos Wind 1 LP, LLC	FPL Pecos Wind I & II, LP	93	WOODWARD1	WOODWRD1	2	Jesse Nevarez	Wind	Unknown
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	DG_Schumansville	DG_Schum	3	Allen Ognoskie	Hydro	20028
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	DG-MCQUEENEY	DG_MCQUE	4	Allen Ognoskie	Hydro	20028
Trent Wind Farm, L.P.	Trent Wind Farm, L.P.	70	TRENT MESA WIND FARM	TRENT	5	Richard Walker	Wind	24322
FPL Energy Upton Wind I, L.P.	FPL Energy Upton Wind I, LP	94	KING MOUNTAIN SW	KING_SW	6	Jesse Nevarez	Wind	Unknown
FPL Energy Upton Wind II, LP	FPL Energy Upton Wind II, LP	96	KING MOUNTAIN NW	KING_NW	7	Jesse Nevarez	Wind	Unknown
FPL Pecos Wind 2 LP, LLC	FPL Energy Pecos Wind I&II, LP	93	WOODWARD 2	WOODWRD2	8	Jesse Nevarez	Wind	24296
Delaware Mountain Wind Farm LP	DELAWARE MOUNTAIN WIND FARM LP	16	DELAWARE MOUNTAIN	DELAWARE	9	Linda Brandi	Wind	23705
Indian Mesa, L.P.	NWP INDIAN MESA WIND FARM LP	17	INDIAN MESA NWP	INDNNWP	10	Linda Brandi	Wind	23745
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	DG_LAKEWOOD TAP	DG_LKWDT	11	Allen Ognoskie	Hydro	20028
Guadalupe-Blanco River Authority	Guadalupe-Blanco River Authority	05-631-1608-3000	CANYON	DG_CANYON	12	Allen Ognoskie	Hydro	20028
Small Hydro of Texas, Inc.	Small Hydro of Texas, Inc.	71	DG_CUERO CSW	CUECPL	13	Linda A. Parker	Hydro	24191
Upton Wind III, LP	FPL Energy Upton Wind III, LP	96	KING MOUNTAIN NE	KING_NE	14	Jesse Nevarez	Wind	20063
FPL Energy Upton Wind IV, LP	FPL Energy Upton Wind IV, LP	96	KING MOUNTAIN SE	KING_SE	15	Jesse Nevarez	Wind	Unknown
Desert Sky Wind Farm 1 LP	Indian Mesa Power Parners I, L.P.	999	Indian Mesa I Wind Power	INDNENR	16	Richard Walker	Wind	24921
Desert Sky Wind Farm 2 LP	Indian Mesa Power Parners II, L.P.	999	Indian Mesa II Wind Power	INDNENR	17	Richard Walker	Wind	24922
Llano Estacado	Llano Estacado Wind Ranch at White Deer	Shell	White Deer	White Deer Wind	18	Craig Dencklau	Wind	23633
Renewable Ventures	Nuon Renewable Ventures	NRV	Green Mountain Solar at Upper Kirby	USAPV003	19	Nuon Renewable Ventures	Solar	26410
Renewable Ventures	Nuon Renewable Ventures	NRV	Green Mountain Solar at The Winston School	USAPV002	20	Nuon Renewable Ventures	Solar	26411
Viridis Energy, LP Atascocita	Viridis Energy, LP - Atascocita	93-01-87393	ATASCOCITA	HB	29	Mr Luong Nguyen	Landfill gas	26813

Table 7-1: ERCOT REC Generator List (cont.)

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Viridis Energy, LP - Coastal Plains	Viridis Energy, LP - Coastal Plains	93-01-16145	COASTAL PLAINS	ALVIN	32	Mr Luong Nguyen	Landfill gas	26812
Viridis Energy, LP - Baytown	Viridis Energy, LP - Baytown	01-62-16561	BAYTOWN	TRM	33	Mr Luong Nguyen	Landfill gas	26811
Viridis Energy, LP - Blue Bonnet	Viridis Energy, LP - Blue Bonnet	93-01-27472	BLUE BONNET	LB	34	Mr Luong Nguyen	Landfill gas	26809
Viridis Energy, LP - Conroe	Viridis Energy, LP - Conroe	Conroe	Conroe	Conroe	35	Mr Luong Nguyen	Landfill gas	26808
Viridis Energy, LP - Security	Viridis Energy, LP - Security	SECURITY	SECURITY	SECURITY	36	Mr Luong Nguyen	Landfill gas	26810
Gas Recovery Systems, Inc.	Gas Recovery Systems	20066	Sunset Farms Electric	Sunset Farms Electric	37	Paul Hesson	Landfill gas	24199
Bio Energy (Austin) LLC	Bio Energy Austin LLC	DG_WALZE	DG_WALZE	DG_WALZE	38	Dennis Bollinger	Biomass	25512
The University of Texas - Houston	University of Texas - Houston	UTHSC	University Center Tower	University Center Tower	42	Rahsaan Arscott	Solar	No. 77027
Sweetwater Wind Power LLC	Sweetwater Wind power LLC	137899477	Sweetwater Wind 1	SWEETWND	43	Kim Takayesu	Wind	28924
Brazos Wind, LP	Brazos Wiind LP	Brazos Wind	Green Mountain Energy Wind Farm at Brazos	BRAZ_WND1	44	Scott McBride	Wind	29025
Brazos Wind, LP	Brazos Wind LP	Brazos Wind	Green Mountain Energy Wind Farm at Brazos	BRAZ_WND2	45	Scott McBride	Wind	29025
Aeolus Wind	Aeolus Wind, LLC	Aeolus Wind, LLC	North Texas	NA	51	Sarah Adams	Wind	NA
Sweetwater Wind Power LLC	Sweetwater Wind Power	Sweet Wind 2	Sweetwater Wind 2	SWEETWND2	52	Kim Takayesu	Wind	30462
Renovar Arlington, Ltd.	Renovar Arlington, Ltd.	Rnvr-1	Village Creek	Vcreek	53	Lisette Cowger	Landfill gas	31083
Renovar Arlington, Ltd.	Renovar Arlington, Ltd.	Rnvr-2	Village Creek	Vcreek	54	Lisette Cowger	Landfill gas	31083
Callahan Divide	FPL Energy Callahan Divide	30385	Callahan Wind Energy	30385	55	David Gonzalez	Wind	30385
Buffalo Gap Wind Farm LLC	Buffalo Gap Wind Farm, LLC	Buffalo Gap	Buffalo Gap Wind Farm	Buffalo Gap	56	Gabe Vaca	Wind	31412
Horse Hollow	FPL Energy Horse Hollow Wind	0	Horse Hollow Wind Energy	0	57	John Mantyh	Wind	31594
Sweetwater Wind Power LLC	Sweetwater Wind Power	603943148	Sweetwater Wind 3 LLC_AE	SWEETWND3	58	Kim Takayesu	Wind	31983
Sweetwater Wind Power LLC	Sweetwater Wind Power	603943148-3000	Sweetwater Wind 3 LLC_CPS	SWEETWND3	59	Kim Takayesu	Wind	31983
American Wind Power Center	American Wind Power Center	Lubbock	AWPC	AWPC#1	60	Coy F. Harris	Wind	32470

Table 7-1: ERCOT REC Generator List (cont.)

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Bio Energy (Texas), LLC	Bio Energy (Texas) LLC	32079	Covel Gardens Landfill Gas Power Station	DG_MEDIN	61	John M. Love	Landfill gas	20140
MeadWestvaco Texas LP	MeadWestvaco Texas LP	Evadale Opertions	MeadWestvaco Evadale Pulp and Paper Mill	Evadale Texas	63	JiNia Bradford	Biomass	31646
Fortistar	G2 Energy (FW Regional) LLC	77-998-1765	DG_RDLML_1 Unit	FW Regional	64	John Bean	Landfill gas	32558
JD Wind 1	JD Wind 1	20137	JD Wind 1	JD Wind 1	65	Steve Maller	Wind	32802
JD Wind 2	JD Wind 2	20138	JD Wind 2	JD Wind 2	66	Steve Maller	Wind	32803
JD Wind 3	JD Wind 3	20139	JD Wind 3	JD Wind 3	67	Steve Maller	Wind	32804
Mesquite Wind, LLC	Mesquite Wind LLC	Horizon Wind	Horizon Wind	Horizon Wind	68	Brian Hayes	Wind	32936
FPL Energy Horse Hollow Wind II, LP	FPL Energy Horse Hollow II, LP	Horse Hollow II	Horse Hollow II	Horse Hollow II	69	John Mantyh	Wind	32524
Post Wind Farm LP	Post Wind Farm, LP	Post Wind	Post Wind	Post Wind	70	John Cote	Wind	32525
JD Wind 5	JD Wind 5	20154	JD Wind 5	JD Wind 5	71	Steven Maller	Wind	32912
JD Wind 6	JD Wind 6	20155	JD Wind 6	JD Wind 6	72	Steven Maller	Wind	32913
Forest Creek Wind Farm, LLC	Airtricity Forest Creek Wind Farm, LLC	210	Forest Creek Wind Farm	MCDLD	74	John Franklin	Wind	20166
JD Wind 4	JD Wind 4	20153	JD Wind 4	JD Wind 4	75	Steven Maller	Wind	33760
Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	Cromeco, Inc.	76	Steve Cromeens	Landfill gas	29520
Sand Bluff Wind Farm, LLC	Airtricity Sand Bluff Wind Farm, LLC	211	Sand Bluff Wind Farm	MCDLD	77	Phil Dutton	Wind	20165
Post Oak Wind, LLC	Post Oak Wind	Post Oak Wind	Post Oak Wind	Post Oak Wind	78	Brian Hayes	Wind	33801
Sweetwater Wind Power LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	Sweetwater Wind 4 LLC	79	Kim Takayesu	Wind	34058
Scurry County Wind, L.P.	Scurry County Wind, L.P.	scurry county wind	Camp Springs Energy Center	CSEC	80	Scott Ebner	Wind	33902
Buffalo Gap Wind Farm 2, LLC	Buffalo Gap Wind Farm 2, LLC	603768792	Buffalo Gap Wind Farm	BUFF_GAP	81	William Barnes	Wind	33477
Sweetwater Wind Power LLC	Sweetwater Wind 5 LLC	Sweetwater Wind 5 LLC	Sweetwater Wind 5 LLC	SWEETWN5	82	Kim Takayesu	Wind	34709
WM Renewable Energy, LLC	WM Renewable Energy, L.L.C.	Skyline	Skyline	DG_FERIS	83	Scott Burnell	Landfill gas	20161

Table 7-1: ERCOT REC Generator List (cont.)

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Maverick County Water Control	Maverick County Water	Maverick County	Maverick County Water	20141	92	Maverick County Water	Hydro	34674
Capricorn Ridge Wind, LLC	Capricorn Ridge Wind, LLC	Capricorn Ridge Wind	Capricorn Ridge	CAPRIDGE	93	Brian Harris	Wind	34549
Mission Wind LLC	Wildorado Wind, LLC	Mission Wind	Mission Wind	Mission Wind	94	Maria Litos	Wind	32900
WM Renewable Energy, LLC	WM Renewable Energy II, LLC	Austin	Austin	DG_SPRIN	95	Steven Korsgaard	Landfill gas	20161
Snyder Wind Farm, LLC	Snyder Wind Farm, LLC	20187	Snyder Wind Farm	ENAS	96	Eric Barreveld	Wind	34754
Rio Grande Valley Sugar Growers, Inc.	RGVSugar	RGVSugar	RGVSugar	RGVSugar	97	Steve Bearden	Biomass	33421
Goat Wind, LP	Goat Wind, LP	809226603	GOAT WIND LP	GOAT WIND	98	Johnny Johnson	Wind	35439
Champion Wind Farm, LLC	Airtricity Champion Wind Farm, LLC	242	Champion Wind Farm	TKWSW	99	Audrey Fogarty	Wind	20182
Roscoe Wind Farm, LLC	Airtricity Roscoe Wind Farm, LLC	243	Roscoe Wind Farm	TKWSW1	100	Audrey Fogarty	Wind	20180
Scurry County Wind II LLC	Scurry County Wind II LLC	scurry county wind II	Camp Springs Energy Center	CSEC	101	Scott Ebner	Wind	35290
Stanton Wind Energy LLC	Stanton Wind Energy LLC	stanton wind	Stanton Wind Energy LLC	SWEC	102	Scott Ebner	Wind	35206
Whirlwind Energy, LLC	Whirlwind Energy, LLC	WELLC	Whirlwind Energy Center	WEC	103	Matthew Burt	Wind	20172
JD Wind 9 LLC	JD Wind 9	20189	JD Wind 9	JD Wind 9	104	Steve Maller	Wind	34924
JD Wind 8 LLC	JD Wind 8	20194	JD Wind 8	JD Wind 8	105	Steven Maller	Wind	34991
JD Wind 10 LLC	JD Wind 10	20195	JD Wind 10	JD Wind 10	106	Steven Maller	Wind	34992
JD Wind 11 LLC	JD Wind 11	20196	JD Wind 11	JD Wind 11	107	Steven Maller	Wind	34993
JD Wind 7 LLC	JD Wind 7	20193	JD Wind 7	JD Wind 7	108	Steven Maller	Wind	34990
Snider Industries, LLP	Snider Industries, LLP	Snider_1	Snider_1	Snider_1	109	Julianna Parr	Biomass	35526
Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm 3, LLC	Buffalo Gap Wind Farm	BUFF_GAP	110	Fang Qing	Wind	35247
High Plains Wnd Power LLC	High Plains Wind Power LLC	20197	High Plains Wind Power	High Plains Wind Power	111	Steven Maller	Wind	34994
Texas Gulf Wind LLC	Texas Gulf Wind LLC	Texas Gulf Wind LLC	Texas Gulf Wind LLC	TGW	112	Kim Takayesu	Wind	35810

Table 7-1: ERCOT REC Generator List (cont.)

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
ECR Panther Creek Wind Farm I and II, LLC	ECR Panther Creek Wind Farm I, LLC.	259	PANTHER CREEK	PC_NORTH	113	Crystal Walton	Wind	20208
Capricorn Ridge Wind II, LLC	Capricorn Ridge Wind II, LLC	CR4	CR4	CR4	114	Daniel Sexton	Wind	20210
South Trent Wind LLC	South Trent Wind LLC	35778	South Trent Wind Farm	STWF	115	Kim Takayesu	Wind	35750
Biofuels Power Corporation	Biofuels Power Inc.	20174	BFP Conroe	35861	116	Christopher Dufour	Biomass	35861
Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	Majestic Wind Power LLC	117	Kim Takayesu	Wind	35871
Biofuels Power Corporation	Biofuels Power Corporation	20174	Oak Ridge North	DG_RA	118	Chris Dufour	Biomass	34211
McAdoo Wind Energy LLC	McAdoo Wind Energy LLC	McAdoo Wind	McAdoo Wind Energy Center	MWEC	119	Scott Ebner	Wind	35935
Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	Noble Great Plains Windpark, LLC	120	Harry Silton	Wind	20227
Sherbino I Wind Farm LLC	Sherbino I Wind Farm, LLC	20220	Sherbino I Wind Farm	KEO	121	James Holly	Wind	35887
Ocotillo Windpower, LP	Ocotillo Windpower LP	Ocotillo Windpower	Ocotillo Windfarm	OWF	122	Jason Allen	Wind	35453
Silver Star I Power Partners, LLC	Silver Star I Power Partners LLC	20186	Silver Star Wind	FLTCK	123	James C Holly	Wind	35551
Hackberry Wind, LLC	Hackberry Wind LLC	HWFLLC	Hackberry Wind Farm	HWF	124	Matthew Burt	Wind	20185
PYCO Industries, Inc.	PYCO Industries, Inc.	70047	PYCO Industries Plant #2	2	125	PYCO Industries, Inc. Wind Farm	Wind	36175
ECR Panther Creek Wind Farm I and II, LLC	EC and R Panther Creek Wind Farm II, LLC	259	PANTHER CREEK	PC_SOUTH	126	Dean Tuel	Wind	35779
Elbow Creek Wind Project, LLC	Elbow Creek Wind Project LLC	Elbow Creek	Elbow Creek	Elbow Creek	127	Scott McBride	Wind	Elbow Creek
Turkey Track Wind Energy LLC	Turkey Track Wind Energy LLC	Turkey Track Wind	Turkey Track Wind Energy Center	TTWEC	128	Scott Ebner	Wind	36369
Wolf Ridge Wind, LLC	Wolf Ridge Wind, LLC	C41483	WOLF RIDGE	WLFRIDGE	129	Rory Robinson	Wind	36015
Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	Bull Creek Wind LLC	131	Michael Adcock	Wind	36239
Sunray Wind, LLC	Sunray Wind, LLC	20234	Sunray Wind, LLC Wind Farm	Sunray Wind, LLC	132	William Root	Wind	36672
Texas State Technical College	Texas State Technical College West Texas	TSTC	TSTC West Texas	DG ROSC2	133	Ray Fried	Wind	20240
Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	Inadale Wind Farm, LLC	INDL_INADALE1	134	Dean Tuel	Wind	36500

Table 7-1: ERCOT REC Generator List (cont.)

Company Name	Power Generating Company Name	Power Generating Company Code	Generator Site Name	Generator Site Code	Facility Identification Number	Unit Contact Information	Technology Type	Facility Noncompetitive Certification Data
Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	Pyron Wind Farm, LLC	PYR_PYRON1	135	Dean Tuel	Wind	36501
Trinity Oaks LLC	G2 Energy (Trinity Oaks) LLC	828961529	Trinity Oaks LFG Generating Facility	DG KLBRG	136	Massimo Passini	Landfill gas	36679
Notrees Windpower, LP	Notrees Windpower LP	Notrees	Notrees Windfarm	NWF	137	Jason Allen	Wind	36350
Iberdrola Renewables, Inc.	Barton Chapel Wind LLC	Barton Chapel	Barton Chapel	Barton Chapel	138	Bobby Clark	Wind	36825
Iberdrola Renewables, Inc.	Penascal Wind Power LLC	Penascal	Penascal	Penascal	139	Dan Pitts	Wind	36829
Denton Power, LLC	Denton Power, LLC	Denton Power	Denton Power	Denton Power	140	Jason Smith	Landfill gas	70051
ECR Panther Creek Wind Farm III, LLC	ECR Panther Creek Creek Wind Farm III, LLC	ECR Panther Creek Creek Wind Farm III, LLC	PANTHER3	PANTHER3	141	Dean Tuel	Wind	20239
Iberdrola Renewables, Inc.	Penascal Wind Power LLC	Penascal/STEC	Penascal/STEC	Penascal/STEC	142	Dan Pitts	Wind	36829
WM Renewable Energy, LLC	WM Renewable Energy, L.L.C.	???	DFW II	DG_BIO2	143	LaToya Glenn	Landfill gas	20161
ECR Papalote I, LLC	ECR Papalote I, LLC	ECR Papalote I, LLC	ECR Papalote I, LLC	ECR Papalote I, LLC	144	John Franklin	Wind	ECR
Langford Wind Power, LLC	Langford Wind Power, LLC	Langford Wind Power, LLC	Langford	Langford	145	Scott McBride	Wind	unknown
Capricorn Ridge Wind, LLC	Capricorn Ridge Wind, LLC	Capricorn Ridge Wind	Capricorn Ridge	CAPRIDGE	146	Brian Harris	Wind	34549
Capricorn Ridge Wind, LLC	Capricorn Ridge Wind, LLC	Capricorn Ridge Wind	Capricorn Ridge	CAPRIDGE	147	Brian Harris	Wind	34549
Michael Laurie Blank	Michael Laurie Blank	Solar	Michael Laurie Blank	Texas	148	Michael Laurie Blank	Solar	37542
Orange County Container LLC	Orange County Container Group LLC	Corrugated Services Inc	Liner Mill Bio-boiler	Liner Mill Bio-boiler	149	David Garrick	Biomass	37531
Loraine Windpark Project, LLC	LORAINE WINDPARK PROJECT LLC	LORAINE WINDPARK PROJECT LLC	LORAINE WINDPARK PROJECT LLC	LONEWOLF	150	Clifford E. Clement	Wind	20247

Table 7-2: Quarterly Electricity Generation by Renewable Sources, in MWh, for 2001 – 2009

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2001					
Hydro	2001	0	0	11293	19346	30639
Landfill gas	2001					
Solar	2001					
Wind	2001	0	0	201,118	364,479	565,597
Totals		0	0	212,411	383,825	596,236

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2002					
Hydro	2002	105,817	69,165	80,154	56,956	312,093
Landfill gas	2002	8,216	7,073	6,986	7,137	29,412
Solar	2002	0	29	37	21	87
Wind	2002	611,708	716,896	622,262	500,618	2,451,484
Totals		725,741	793,163	709,439	564,732	2,793,076

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2003	8,876	11,253	10,999	8,368	39,496
Hydro	2003	92,680	52,592	71,699	22,713	239,684
Landfill gas	2003	29,995	44,629	39,920	39,662	154,206
Solar	2003	32	70	69	49	220
Wind	2003	561,994	670,248	617,794	665,446	2,515,482
Totals		693,577	778,792	740,481	736,238	2,949,088

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2004	6,274	11,459	11,482	7,725	36,940
Hydro	2004	55,638	52,735	52,350	74,067	234,791
Landfill gas	2004	52,801	47,964	53,659	49,018	203,443
Solar	2004	31	67	70	44	211
Wind	2004	815,010	1,014,396	610,157	770,066	3,209,629
Totals		929,755	1,126,621	727,718	900,920	3,685,014

Table 7-2: Quarterly Electricity Generation by Renewable Sources, in MWh, for 2001 – 2009 (cont.)

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2005	13,921	15,069	14,764	14,883	58,637
Hydro	2005	108,974	106,893	61,189	33,246	310,302
Landfill gas	2005	52,118	51,193	56,166	54,301	213,777
Solar	2005	46	69	67	46	227
Wind	2005	801,232	1,246,182	869,508	1,304,646	4,221,568
Totals		976,291	1,419,406	1,001,694	1,407,122	4,804,511

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2006	16,327	10,479	17,152	16,610	60,569
Hydro	2006	55,000	83,064	44,870	27,143	210,077
Landfill gas	2006	69,191	78,650	75,665	82,580	306,087
Solar	2006	26	43	41	360	470
Wind	2006	1,478,927	1,584,166	1,376,540	2,091,295	6,530,928
Totals		1,619,471	1,756,402	1,514,268	2,217,988	7,108,131

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2007	13,052	15,870	13,073	12,105	54,101
Hydro	2007	66,084	120,486	139,965	56,346	382,882
Landfill gas	2007	84,367	86,372	85,612	99,987	356,339
Solar	2007	339	503	541	461	1,844
Wind	2007	1,961,153	2,029,807	2,020,870	3,339,338	9,351,168
Totals		2,124,995	2,253,039	2,260,062	3,508,238	10,146,334

Technology Type	Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total MWh
Biomass	2008	21,154	14,019	12,564	23,095	70,833
Hydro	2008	98,510	177,051	78,751	91,116	445,428
Landfill gas	2008	105,217	97,361	88,470	95,558	386,606
Solar	2008	446	862	992	1,038	3,338
Wind	2008	4,030,973	4,737,188	2,639,509	4,878,770	16,286,440
Totals		4,256,300	5,026,481	2,820,287	5,089,577	17,192,645

Table 7-2 Quarterly Electricity Generation by Renewable Sources, in MWh, for 2001 – 2009 (cont.)

Technology Type	**Year**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total MWh**
Biomass	2009	25,083	18,938	17,187	12,156	73,364
Hydro	2009	76,480	179,512	88,491	163,024	507,507
Landfill gas	2009	94,382	101,709	104,854	111,981	412,926
Solar	2009	101	1,409	1,761	1,222	4,492
Wind	2009	5,413,648	5,385,203	4,248,223	5,548,915	20,595,989
Totals		5,609,694	5,686,771	4,460,516	5,837,298	21,594,278

Table 7-3: Annual Electricity Generation by Renewable Sources (MWh, ERCOT: 2001 – 2009 by Quarter)

Technology Type	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Wind	565,597	2,451,484	2,515,482	3,209,629	4,221,568	6,530,928	9,351,168	16,286,440	20,595,989
Hydro	30,639	312,093	239,684	234,791	310,302	210,077	382,882	445,428	507,507
Landfill gas		29,412	154,206	203,443	213,777	306,087	356,339	386606	412,926
Biomass			39,496	36,940	58,637	60,569	54101	70,833	73,364
Solar		87	220	211	227	470	1,844	3,338	4,492
Totals	596,236	2,793,076	2,949,088	3,685,014	4,804,511	7,108,131	10,146,334	17,192,645	21,594,278

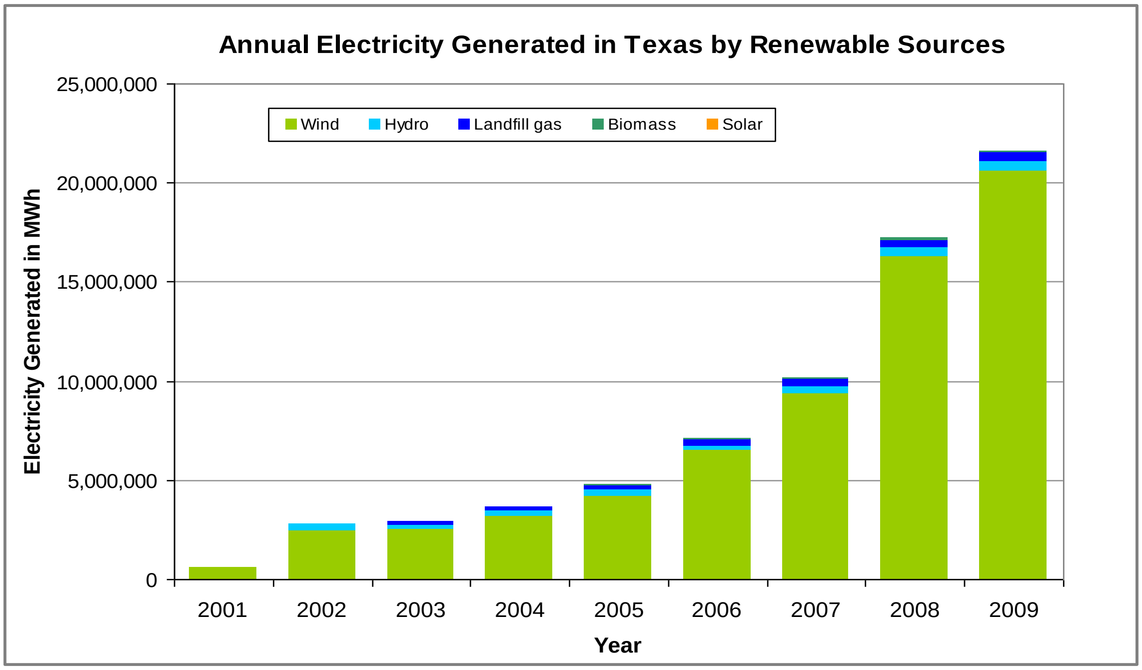


Figure 7-1: Electricity Generation by Renewable Sources (ERCOT: 2001 – 2009 Annual)

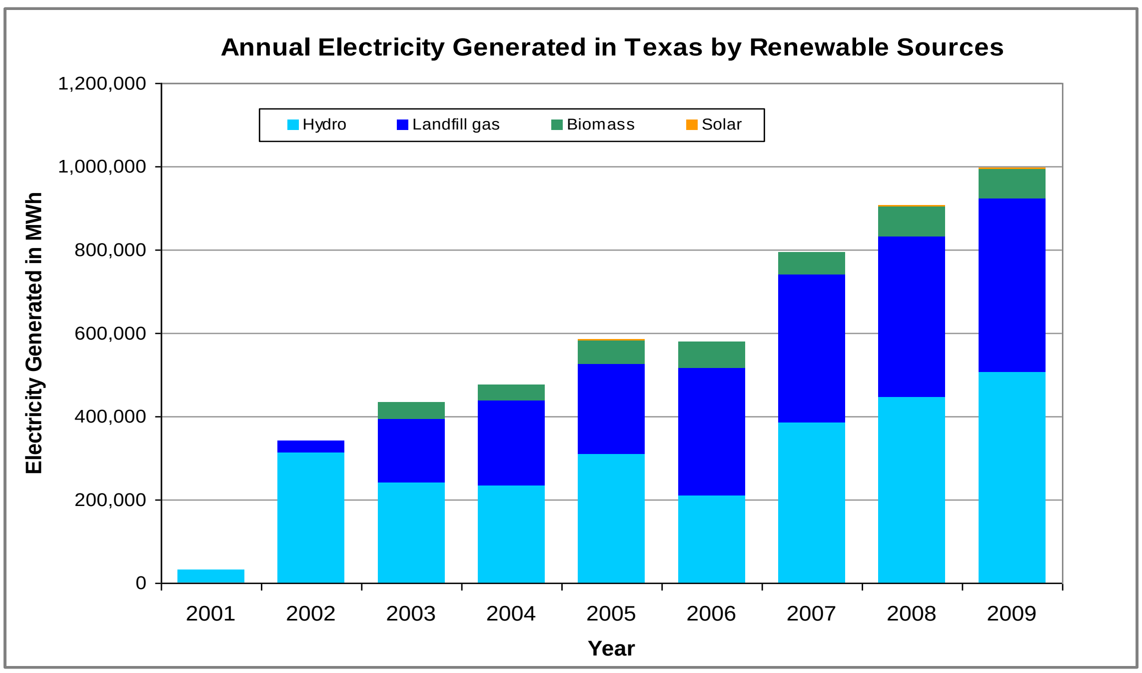


Figure 7-2: Electricity Generation by Renewable Sources Other Than Wind (ERCOT: 2001 – 2009 Annual)

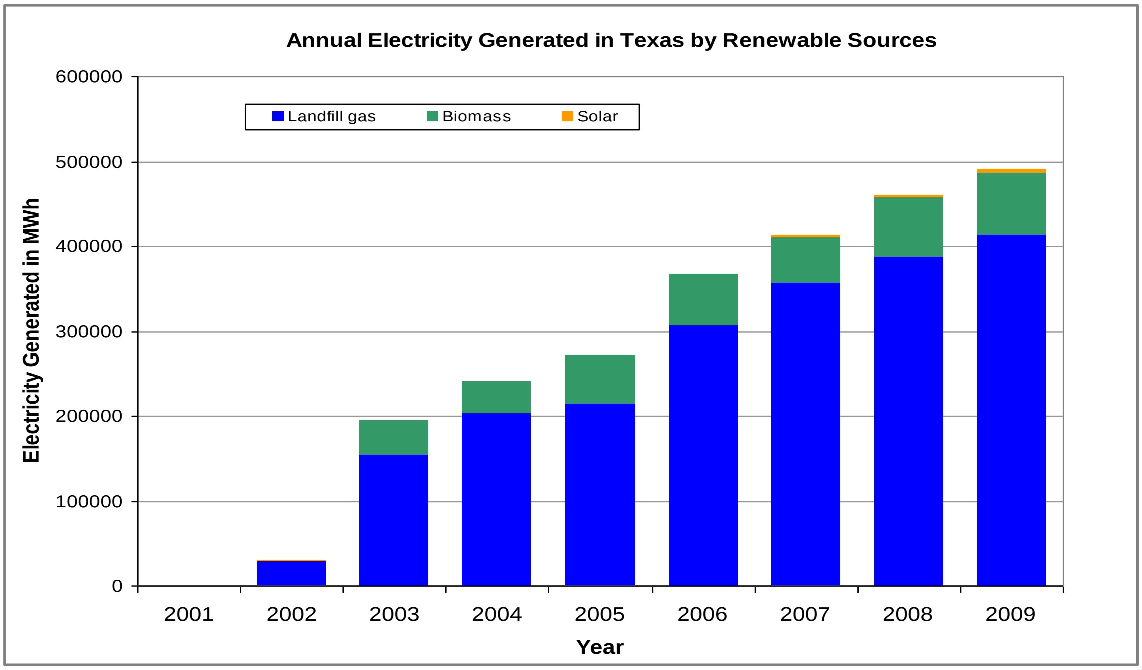


Figure 7-3: Electricity Generation by Renewable Sources from Landfill gas, Solar and Biomass (ERCOT: 2001 – 2009 Annual)

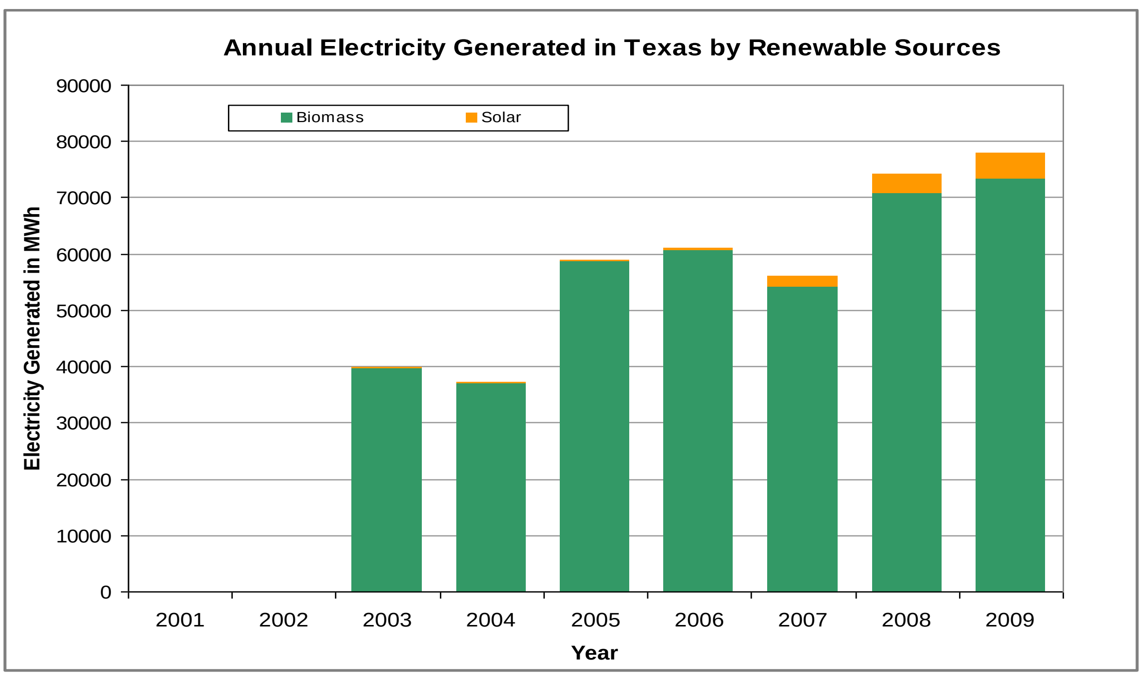


Figure 7-4: Electricity Generation by Renewable Sources from Solar and Biomass (ERCOT: 2001 – 2009 Annual)

8 COMBINED HEAT AND POWER PROJECTS IN TEXAS

Texas leads the United States in Combined Heat and Power (CHP) applications, which is also known as cogeneration. About 23% of all CHP generation capacity in the US is located in Texas[9]. This capacity produces 20% of the electricity in Texas[10]. In Texas, typical power plants built by electric utilities are steam plants that are 25% - 35% efficient. The natural gas combined cycle power plants operate at about 50% efficiency. CHP technologies generate electrical and thermal energy in a single, integrated system close to the point of customer energy demand. A typical CHP system consists of a prime mover to generate electricity, a heat recovery system to capture heat, a control system, an exhaust system, and an acoustic enclosure. The thermal energy recovered in a CHP system can be used for heating or cooling in industry or buildings. Thus, CHP facilities are a major energy conservation technique with a high efficiency falling to the 70% - 85% range.

The ESL is working on developing a procedure to calculate annually creditable NOx emissions reductions from CHP facilities for the State Implementation Plan (SIP) credits. The ESL is collecting new, or updating, information which be presented in the next annual report.

[9] USDOE, Energy Information Agency (EIA), 2005 data
[10] USDOE, Energy Information Agency (EIA), 2006 data

9 REPORTING OF NO_X EMISSIONS CREDITS TO THE TCEQ (PRELIMINARY)

9.1 Introduction

The Energy Systems Laboratory (Laboratory), at the Texas Engineering Experiment Station of the Texas A&M University System, in fulfillment of its responsibilities under Texas Health and Safety Code Ann. § 388.003 (e), Vernon Supp. 2002, submits this sixth annual report, Energy Efficiency/Renewable Energy (EE/RE) Impact in the Texas Emissions Reduction Plan (Preliminary Report) to the Texas Commission on Environmental Quality.

In this preliminary report, the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day[11] (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

In 2009, the cumulative total annual electricity savings from all programs is 25,585,081 MWh/year (15,327 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 70,442 MWh/day, which would be a 2,935 MW average hourly load reduction during the OSD period (40.72 tons-NOx/day). By 2013, the total cumulative annual electricity savings from will be 31,979,929 MWh/year (19,314 tons-NOx/year). The total cumulative OSD electricity savings from all programs will be 92,099 MWh/day, which would be a 3,837 MW average hourly load reduction during the OSD period (54.15 tons-NOx/day). A summary of the savings for 2009 and 2013 is presented in the table below.

	2009	2013
Annual Electricity Savings (MWh/yr)	25,585,081	31,979,929
Annual Emissions reductions (tons NOx/yr)	15,327	19,314
OSD Electricity Savings (MWh/day)	70,442	92,099
OSD Emissions reductions (tons NOx/day)	40.72	54.15

[11] An ozone season day (OSD) represents the daily average emissions during the period that runs from mid-July to mid -September.

9.2 Legislative Background

In 2001, the Texas Emissions Reduction Plan (TERP), established by the 77th Texas Legislature with the enactment of Senate Bill 5 (SB 5), identified that Energy Efficiency and Renewable Energy (EE/RE) measures make an important contribution to a comprehensive approach for meeting the minimum federal ambient air quality standards. In 2003 through 2007, the 78th, 79th and 80th Legislatures enhanced the use of EE/RE programs for meeting the TERP. The 78th Legislature enhanced the use of EE/RE programs for meeting TERP goals by requiring the Texas Commission on Environmental Quality (TCEQ) to promote EE/RE as a means to improve air quality standards and to develop a methodology for computing emissions reduction for use in the State Implementation Plan (SIP) from EE/RE programs.

The 79th Legislature expanded the scope of the SIP-eligible credits by adding savings from the State Renewable Portfolio Standards from the generation of electricity from renewable sources; specifically requiring the TCEQ to develop methods to quantify emissions reductions from renewable energy; and required the Laboratory to develop at least 3 alternative methods for achieving a 15 percent greater potential energy savings in residential, commercial and industrial construction. In the 80th Legislature several new energy efficiency initiatives were introduced, including: requiring the Laboratory to provide written recommendations to the State Energy Conservation Office (SECO) about whether or not the energy efficiency provisions of latest published edition of the International Residential Code (IRC), or the International Energy Conservation Code (IECC), are equivalent to or better than the energy efficiency and air quality achievable under the editions adopted under the 2001 IRC/IECC; requiring the Laboratory to develop a standardized report format to be used by providers of home energy ratings; and encouraging the Laboratory to cooperate with an industry organization or trade association to develop guidelines for home energy ratings, including training.

9.3 Calculation of Integrated NOx Emissions Reductions from Multiple State Agencies Participating in the Texas Emissions Reduction Plan (TERP)

In January 2005, the Laboratory was asked by the Texas Commission on Environmental Quality (TCEQ) to develop a method by which the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 could be reported in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2007 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose. The different programs included in the 2006 cumulative analysis are:

- ESL Single-family new construction
- ESL Multi-family new construction
- ESL Commercial new construction
- Federal Buildings
- Furnace Pilot Light Program
- PUC Senate Bill 7 and Senate Bill 5 Program
- SECO Senate Bill 5 Program
- Electricity generated by wind farms in Texas (ERCOT)[12]
- SEER13 upgrades to Single-family and Multi-family residences

The Laboratory's single-family and multi-family programs include the energy savings attained by constructing new residences in Texas according to the IECC 2000/2001 building code (IECC 2000). The baseline for comparison for the code programs is the published data on residential construction

[12] ERCOT is the Electric Reliability Council of Texas.

characteristics by the National Association of Home Builders (NAHB) for 1999 (NAHB 1999). Annual electricity (MWh) and natural gas (MMBtu) savings are from the Laboratory's Annual Reports to the TCEQ (Haberl et al., 2002 - 2007).

The Texas Public Utility Commission's (PUC) Senate Bill and Senate Bill 7 programs include their incentive and rebates programs managed by the different Utilities for Texas (PUC 2007). These include the Residential Energy Efficiency Programs (REEP) as well as the Commercial & Industrial Standard Offer Programs (C&I SOP). The energy efficiency measures include high efficiency HVAC equipment, variable speed drives, increased insulation levels, infiltration reduction, duct sealing, Energy Star Homes, etc. Annual electricity savings according to the utilities (or Power Control Authorities – PCAs) were reported for the different programs completed in the years 2001 through 2009. The PUC also reported the savings from the Senate Bill 5 grant program which was conducted in 2002 and 2003.

The Texas State Energy Conservation Office (SECO) funds energy-efficiency programs are directed towards school districts, government agencies, city and county governments, private industries and residential energy consumers. For the 2009 reporting year SECO submitted annual energy savings values for 149 projects, which included projects funded by SECO and by Energy Service projects.

The *Electric Reliability Council of Texas (ERCOT) electricity production from currently installed green power generation (wind)* in Texas is reported. Projections through 2013 include planned projects by ERCOT, annual growth factors beyond 2013 comply with the Legislative requirements. Actual measured electricity production for 2001 through 2009, were included.

Finally, NOx emissions reductions from several other programs are also reported, including: *energy efficiency measures applied to Federal buildings in Texas, reductions from the elimination of pilot lights in residential furnaces, and reductions from the installation of SEER 13 air conditioners in existing residences.*

9.4 Description of the Analysis Method

Annual and Ozone Season Day (OSD) NOx emissions reduction were calculated for 2009 and cumulatively from 2006 to 2020 using several factors to discount the potential savings. These factors include an annual degradation factor, a transmission and distribution factor, a discount factor and growth factors as shown inTable 9-1, and are described as follows:

Annual degradation factor: This factor was used to account for an assumed decrease in the performance of the measures installed as the equipment wears down and degrades. With the exception of electricity generated from wind, an annual degradation factor of 5% was used for all the programs[13]. This value was taken from a study by Kats et al. (1996).

Transmission and distribution loss: This factor adjusts the reported savings to account for the loss in energy resulting from the transmission and distribution of the power from the electricity producers to the electricity consumers. For this calculation, the energy savings reported at the consumer level are increased by 7% to give credit for the actual power produced that is lost in the transmission and distribution system on its way to the customer. In the case of electricity generated by wind, the T&D losses were assumed to cancel out since wind energy is displacing power produced by conventional power plants; therefore, there is no net increase or decrease in T&D losses.

Initial discount factor: This factor was used to discount the reported savings for any inaccuracies in the assumptions and methods employed in the calculation procedures. For the Laboratory's single- and multi-

[13] A degradation of 5% per year would accumulate as a 5%, 10%, 15%...etc, degradation in performance. Although the assumption of this high level of degradation may not actually occur, it was chosen as a conservative estimate. For wind energy, a degradation factor of 0% was used. The choice of a 0% degradation factor for wind is based on two year's of analysis of measured wind data from all Texas wind farms that shows no degradation, on average, for a two year period after the wind farms became operational.

family program, the discount factor was assumed to be 20%. For PUC's Senate Bill 5 and Senate Bill 7 programs and electricity from wind, the discount factor was taken as 25%. For the savings in the SECO program, the discount factor was 60%.

Growth factor: The growth factors shown in Table 9-1 were used to account for several different factors. Growth factors for single-family (3.25%) and multi-family residential (1.54%) construction are projections based on the average growth rate for these housing types from recent U.S. Census data for Texas. Growth factors for wind energy are from the Texas Public Utilities Commission[14]. No growth was assumed for Federal buildings, pilot lights, PUC programs and SECO entries.

Figure 9-1 shows the overall information flow that was used to calculate the NOx emissions savings from the annual and Ozone Season Day (OSD) electricity savings (MWh) from all programs. For the Laboratory's single-family and multi-family code-implementation programs, the annual and ozone season savings were calculated from DOE-2 hourly simulation models[15]. The base case is taken as the average characteristics of single- and multi-family residences for Texas published by the National Association of Home Builders for 1999 (NAHB 1999). The OSD consumption is the average daily consumption for the period between July 15 and September 15, 1999. The annual electricity savings from PUC programs were calculated using deemed savings tables and spreadsheets created for the utilities incentive programs by Frontier Associates in Austin, Texas (PUC 2007).

The SECO electricity savings were submitted as annual savings by project[16]. A description of the measures completed for the project was also submitted for information purposes. The electricity production from wind farms in Texas was from the actual on-site metered data measured at 15-minute intervals.

Integration of the savings from the different programs into a uniform format allowed for creditable NOx emissions to be evaluated using different criteria as shown inTable 9-1. These include evaluation across programs, evaluation across individual counties by program, evaluation by SIP area, evaluation for all ERCOT counties except Houston/Galveston, and evaluation within a 200 km radius of Dallas/Ft.Worth.

9.5 Calculation Procedure

ESL Single-family and Multi-family. The calculation of the annual and OSD electricity savings reported for the years 2002 through 2009 included the savings from code-compliant new housing in all 41 non-attainment and affected counties as reported in the Laboratory's annual report submitted by the Laboratory to the Texas Commission of Environmental Quality (TCEQ). The savings for 2001 were also incorporated, since some of the programs were reporting savings from September to December 2001. From 2005 to 2009, the annual and OSD electricity savings were calculated for new residential construction in all the counties in ERCOT region, which includes the 41 non-attainment and affected counties. These savings were then tabulated by county and program. Using the calculated values through 2009, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above.

In these calculations, it was assumed that the same amount of electricity savings from the code-complaint construction would be achieved for each year after 2009 through 2020[17]. The projected energy savings through 2020, according to county, were then divided into the different Power Control Authorities (PCA) in

[14] The growth factors for wind energy through 2012 are based on permitted wind farms registered with the Texas Public Utilities Commission, http://www.puc.state.tx.us/electric/maps/gen_tables.xls. Growth factors for 2013 through 2020 assume a linear projection based on the permits for 2011 and 2012.

[15] These values are based on a performance analysis as defined by Chapter 4 of IECC 2000/2001. This analysis is discussed in the Laboratory's annual reports to the TCEQ.

[16] The reporting requirements to the SECO did not require energy savings by project type, although for selected sites, energy savings by project type was available. Annual savings were reported by SECO in 2004. Values for 2005 to 2007 use the adjusted values from 2004 as shown, www.seco.cpa.state.tx.us.

[17] This would include the appropriate discount and degradation factors for each year.

eGRID. To determine which PCA was to be used, or in counties with multiple PCA, the allocation to each PCA by county was obtained from PUC's listing published in the Laboratory's 2005 annual report[18].

For the 2009 annual and OSD NOx emissions calculations, the US EPA's 2007 eGRID were used[19]. An example of the eGRID spreadsheet[20] is given inTable 9-2. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties using the emissions factors contained in eGRID. Similar calculations were performed for each year for which the analysis was required. The cumulative NOx emissions reduction for the electricity savings from residential new construction for 2006 through 2020 is provided inTable 9-3. NOx emissions reduction is provided in Table 9-4.

ESL-Commercial Buildings. The annual and OSD electricity savings for 2002 through 2009 for commercial buildings were obtained from the annual reports for 2005 and 2008 submitted by the Laboratory to TCEQ[21]. These savings were also tabulated by county and program. Using the calculated values through 2009, savings were then projected to 2020 by incorporating the different adjustment factors mentioned above[22]. In the projected 2009 cumulative electricity savings, it was assumed that the same amount of electricity savings from 2009 would be achieved for each year after 2009 through 2020. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were allocated into the appropriate Power Control Authorities (PCA).

Federal Buildings. Energy savings achieved from Energy Savings Performance Contracts (ESPCs) were also reported in 2009. This includes savings (estimated) from energy conservation measures implemented in Federal Buildings in Texas. The 2009 savings include projects implemented in 14 Federal buildings reported by the regional office of the Department of Energy. Annual kWh savings reported for each of the projects were divided by 365 to obtain the average Ozone Season Day savings[23]. In the calculation for 2009, it was assumed that the electricity savings from 2006 would also be achieved for each year from 2009 through 2020 after the appropriate degradation factors were applied. Similarly to the single family calculations, the projected energy saving numbers through 2020, by county, were proportioned into the PUC's Power Control Authorities (PCA) and the cumulative NOx emission reduction values calculated.

Furnace Pilot Light Program. For the furnace pilot light program savings, the N.G. energy savings achieved by retrofitting existing furnaces in single-family and multi-family residences for the entire residential stock for Texas have been projected until 2020. Pilot light removal saves an estimated 500 Btu/hr of natural gas for each hour of operation for the entire life of the furnace when the furnace is replaced with a code-compliant replacement. The energy savings for the Ozone Season Day are calculated by dividing the annual number by 365. It is also being assumed that of the total furnaces that were retrofitted, 75% are operational during the Ozone Season Period. Cumulative NOx emissions reduction for the N.G. savings from the removal of furnace pilot lights were also calculated by county for 2006 through 2020 by SIP area[24].

[18] Haberl et al., 2005, pp. 197.
[19] This required two separate versions of the 2007 eGRID, which were specially prepared for Texas by Mr. Art Diem at the US EPA. One of the versions contains estimates of annual SOx, NOx and CO2 data for 2007, using a 25% capacity factor. The second version contains estimates of SOx, NOx and CO2 data for 2007 for an average day in the ozone season period, which runs from Mid July to Mid September.
[20] To use this spreadsheet electricity savings for each PCA is entered in the bottom row of the spreadsheet (MWh). The spreadsheet then allocates the MWh of electricity savings according to the counties (blue columns) where the PCA owned and operated a power plant. Totals for all PCAs are then listed on the far right columns (white columns). Similar spreadsheets for the 2007 eGRID exist for SOx and CO2.
[21] These savings include new construction in office, assembly, education, retail, food, lodging and warehouse construction as defined by Dodge building type (Dodge 2005), using energy savings from the Pacific Northwest National Laboratory (USDOE 2004), and data from CBECS (1995 - 2003).
[22] This also includes the appropriate discount and degradation factors for each year.
[23] This method yields suitable OSD values for lighting retrofits and/or retrofits that are not weather dependent. In the case of retrofits to cooling systems, weather normalization would increase the OSD savings substantially. Retrofits to heating systems would be reduced by weather normalization.
[24] These use the NOx/MMBtu values provided in the US EPA AP 42 guideline.

PUC-Senate Bill 7. For the PUC Senate Bill 7 program savings, the annual electricity savings for 2001 through 2009 were obtained from the Public Utilities Commission[25]. Using these values savings were projected through 2020 by incorporating the different adjustment factors mentioned above. Similar savings were assumed for each year after 2009 until 2020. The 2009 annual and OSD eGRID was also used to calculate the NOx emissions savings for the PUC-Senate Bill 7 program. The total electricity savings for each PCA was used to calculate the NOx emissions reduction for each county using the emissions factors contained in the US EPA's eGRID spreadsheet. The cumulative NOx emissions reduction for each county, by SIP area, for the different programs was then calculated.

PUC-Senate Bill 5 Grants Program. To calculate the annual electricity savings from the PUC's Senate Bill 5 program, electricity savings were also obtained from the Public Utilities Commission[26]. The annual and average day electricity savings were then proportioned according to the PCA and program. Using the actual reported numbers through 2009, savings through 2020 were projected incorporating the different adjustment factors mentioned above[27]. The 2008 annual and OSD eGRID were used to calculate the NOx emissions savings for PUC-Senate Bill 5 Grants Program. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different counties.

SECO Savings. The annual electricity savings from energy conservation projects reported by political subdivisions for 35 counties through 2009 were obtained from the State Energy Conservation Office[28]. These submittals included information gathered from SECO's website[29] and paper submittals[30]. The annual and average day electricity values were then summarized according to county and program. Using the actual reported numbers for 2004, savings through 2020 were projected using the different adjustment factors mentioned above. In a similar fashion to the previous programs, it was assumed that the same amount of electricity savings will be achieved for each year after 2005 until 2020. The 2009 annual and OSD eGRID were then used to calculate the NOx emissions savings for the SECO program.

Electricity Generated by Wind Farms. The measured electricity production from all the wind farms in Texas for 2001 through 2009 was obtained from the Energy Reliability Council of Texas (ERCOT). To obtain the annual production, the 15-minute data were summed for the 12 months, while for the OSD period the data were converted to average daily electricity production during the months of July, August and September. Using the reported numbers for 2009, savings through 2020 were projected incorporating the different adjustment factors mentioned above. The 2009 annual and OSD eGRID were then used to calculate the NOx emissions reduction for the electricity generated by Texas' wind farms[31]. The total electricity savings for each PCA was used to calculate the NOx emissions reduction for each of the different counties.

SEER 13 Single-Family and Multi-family. In January of 2006, Federal regulations mandated that the minimum efficiency for residential air conditioners be increased to SEER 13 from the previous SEER 10. Although the electricity savings from new construction reflected this change in values, the annual and OSD

[25] In a similar fashion to the previous programs, to obtain the Ozone Season Day (OSD) savings, the annual electricity savings were divided by 365.
[26] In a similar fashion as the PUC's Senate Bill 7 program, the annual electricity savings numbers were then divided by 365 to get average electricity savings per day for OSD calculations. The preferred approach would be to weather-normalize the savings and then calculate savings for the OSD period. However, only annual values were obtained for the 2005 report to the TCEQ. Dividing the annual values by 365 is probably a reasonable approach for lighting projects. However, this undercounts potential savings from electric loads associated with the cooling season.
[27] Since the savings for the PUC's Senate Bill 5 were only reported for two years these savings actually reduced due to the imposed degradation factor.
[28] In a similar fashion as the PUC's Senate Bill 5 and 7 programs, these annual electricity savings numbers were divided by 365 to get average electricity savings per day for the OSD calculations.
[29] This web site was developed for SECO by the Laboratory, at the request of the TCEQ.
[30] In these submittals, there were several municipalities whose electricity or natural consumption increased in 2004 as compared to 2001, which caused the reported savings from these municipalities to be negative. Since no additional information was reported from these projects that might have indicated what the cause of this was, it was assumed that the energy conservation projects were working as designed, but that other factors had changed the energy consumption. Therefore, in the final values of electricity savings from the political subdivisions that reported to SECO for the calculation of annual and OSD NOx reductions, the negative savings were omitted.
[31] This credited the electricity generated by the wind farm to the utility that either owned the wind farm or was associated with the wind farm owner.

electricity savings from the replacement of the air conditioning units by air conditioners with an efficiency of SEER 13 in existing residences needed to be calculated.

In the 2009 report to the TCEQ, the annual and OSD electricity savings for all the counties in ERCOT region as well as the 41 non-attainment and affected counties was calculated for the retrofit. Using the numbers for 2009, the savings through 2020 were projected by incorporating the appropriate adjustment factors[32]. In this analysis it was assumed that an equal number of existing houses had their air conditioners replaced, as reported for 2008, by the air conditioner manufacturers. This replacement rate continued until all the existing air conditioner stock was replaced with SEER 13 air conditioners. The total electricity savings for each PCA were used to calculate the NOx emissions reduction for each of the different county using the emissions factors contained in the 2007 eGRID. Cumulative NOx emissions reduction for each county by SIP area was also calculated.

9.6 Results

The total cumulative annual and OSD electricity savings for all the different programs in the integrated format was calculated using the adjustment factors shown in Table 9-1for 2001 through 2020 as shown in Table 9-3. NOx emissions reduction from the electricity and natural gas savings for the annual and OSD for all the programs in the integrated format is shown inTable 9-4. In Table 9-3 and Table 9-4 annual values are shown for 2005, and cumulative annual values are shown 2006 through 2020. The OSD NOx emissions reduction is also shown in Figure 9-2 as stacked bar charts and Figure 11-3in for the individual components.

In 2009 (Table 9-3), the cumulative annual electricity savings[33] from code-compliant residential and commercial construction is calculated to be 1,688,687 MWh/year (6.6% of the total electricity savings), savings from retrofits to Federal buildings is 251,708 MWh/year (1.0%), savings from furnace pilot light retrofits is 2,548,904 MMBtu/year (2.9%), which is equivalent to 746,822 MWh/year, savings from the PUC’s Senate Bill 5 and Senate Bill 7 programs is 2,347,661 MWh/year (9.2%), savings from SECO’s Senate Bill 5 program is 457,921 MWh/year (1.8%), electricity savings from green power purchases (wind) is 18,808,351 MWh/year (73.5%), and savings from residential air conditioner retrofits[34] is 1,283,931 MWh/year (5.0%). The total savings from all programs is 25,585,081 MWh/year (24,838,258 MWh/year and 2,548,904 MMBtu/year).

In 2009, the cumulative OSD electricity savings from code-compliant residential and commercial construction is calculated to be 9,510 MWh/day (13.5%), savings from retrofits to Federal buildings is 690 MWh/day (1.0%), savings from furnace pilot light retrofits is 6,983 MMBtu/day (2.9%), which is equivalent to 2,046 MWh/day, savings from the PUC’s Senate Bill 5 and Senate Bill 7 programs is 6,432 MWh/day (9.1%), savings from SECO’s Senate Bill 5 program is 1,255 MWh/day (1.8%), electricity savings from green power purchases (wind) are 41,403 MWh/day (58.8%), and savings from residential air conditioner retrofits are 9,106 MWh/day (12.9%). The total savings from all programs is 70,442 MWh/day (68,396 MWh/day and 6,983 MMBtu/day), which would be a 2,935 MW average hourly load reduction during the OSD period.

By 2013, the cumulative annual electricity savings from code-compliant residential and commercial construction is calculated to be 2,176,034 MWh/year (6.8% of the total electricity savings), savings from retrofits to Federal buildings will be 402,732 MWh/year (1.3%), savings from furnace pilot light retrofits will remain at 2,548,904 MMBtu/year (2.3%), which is equivalent to 746,822 MWh/year, savings from the PUC’s Senate Bill 5 and Senate Bill 7 programs will be 3,451,976 MWh/year (10.8%), savings from SECO’s Senate Bill 5 program will be 489,440 MWh/year (1.5%), electricity savings from green power

[32] Additional details about this calculation are contained in the Laboratory’s 2006 Annual Report to the TCEQ, available at the Senate Bill 5 web site “eslsb5.tamu.edu”.
[33] This includes the savings from 2001 through 2009.
[34] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.

purchases (wind) will be 22,426,692 MWh/year (70.1%), and savings from residential air conditioner retrofits[35] will be 2,286,233 MWh/year (7.1%). The total savings from all programs will be 31,979,929 MWh/year (31,233,107 MWh/year and 2,548,904 MMBtu/year).

By 2013, the cumulative OSD electricity savings from code-compliant residential and commercial construction is calculated to be 12,567 MWh/day (13.6%), savings from retrofits to Federal buildings will be 1,103 MWh/day (1.2%), savings from furnace pilot light retrofits will remain at 6,983 MMBtu/day (2.2%), which is equivalent to 2,046 MWh/day, savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 9,457 MWh/day (10.3%), savings from SECO's Senate Bill 5 program will be 1,341 MWh/day (1.5%), electricity savings from green power purchases (wind) will be 49,369 MWh/day (53.6%), and savings from residential air conditioner retrofits will be 16,216 MWh/day (17.6%). The total savings from all programs will be 92,099 MWh/day (90,053 MWh/day and 6,983 MMBtu/day), which would be a 3,837 MW average hourly load reduction during the OSD period.
In 2009 (Table 9-4), the cumulative annual NOx emissions reduction[36] from code-compliant residential and commercial construction is calculated to be 1,189 tons-NOx/year (7.8% of the total NOx savings), savings from retrofits to Federal buildings is 193 tons-NOx/year (1.3%), savings from furnace pilot light retrofits is 117 tons-NOx/year (0.8%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 1,637 tons-NOx/year (10.7%), savings from SECO's Senate Bill 5 program is 349 tons-NOx/year (2.3%), electricity savings from green power purchases (wind) is 10,957 tons-NOx/year (71.5%), and savings from residential air conditioner retrofits is 884 tons-NOx/year (5.8%). The total NOx emissions reduction from all programs is 15,327 tons-NOx/year.

In 2009, the cumulative OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 6.57 tons-NOx/day (16.1%), savings from retrofits to Federal buildings is 0.51 tons-NOx/day (1.2%), savings from furnace pilot light retrofits is 0.32 tons-NOx/day (0.8%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs is 4.39 tons-NOx/day (10.8%), savings from SECO's Senate Bill 5 program is 0.95 tons-NOx/day (2.3%), electricity savings from green power purchases (wind) are 21.79 tons-NOx/day (53.5%), and savings from residential air conditioner retrofits are 6.19 tons-NOx/day (15.2%). The total NOx emissions reduction from all programs is 40.72 tons-NOx/day.

By 2013, the cumulative NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 1,540 tons-NOx/year (8.0% of the total NOx savings), savings from retrofits to Federal buildings will be 308 tons-NOx/year (1.6%), savings from furnace pilot light retrofits will be 117 tons-NOx/year (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 2,336 tons-NOx/year (12.1%), savings from SECO's Senate Bill 5 program will be 373 tons-NOx/year (1.9%), electricity savings from green power purchases (wind) will be 13,065 tons-NOx/year (67.6%), and savings from residential air conditioner retrofits will be 1,575 tons-NOx/year (8.2%). The total NOx emissions reduction from all programs will be 19,314 tons-NOx/year.

By 2013, the cumulative OSD NOx emissions reduction from code-compliant residential and commercial construction is calculated to be 8.72 tons-NOx/day (16.1%), savings from retrofits to Federal buildings will be 0.81 tons-NOx/day (1.5%), savings from furnace pilot light retrofits will be 0.32 tons-NOx/day (0.6%), savings from the PUC's Senate Bill 5 and Senate Bill 7 programs will be 6.28 tons-NOx/day (11.6%), savings from SECO's Senate Bill 5 program will be 1.01 tons-NOx/day (1.9%), electricity savings from green power purchases (wind) will be 25.99 tons-NOx/day (48.0%), and savings from residential air conditioner retrofits will be 11.03 tons-NOx/day (20.4%). The total NOx emissions reduction from all programs will be 54.15 tons-NOx/day.

[35] This assumes air conditioners in existing homes are replaced with the more efficient SEER 13 units, versus an average of SEER 11, which is slightly more efficient than the previous minimum standard of SEER 10.
[36] These NOx emissions reduction were calculated with the US EPA's 2007 eGRID for annual (25% capacity factor) and Ozone Season Day OSD.

9.7 Summary

This preliminary report the NOx emissions savings from the energy-efficiency programs from multiple Texas State Agencies working under Senate Bill 5 and Senate Bill 7 in a uniform format to allow the TCEQ to consider the combined savings for Texas' State Implementation Plan (SIP) planning purposes. This required that the analysis should include the cumulative savings estimates from all projects projected through 2020 for both the annual and Ozone Season Day[37] (OSD) NOx reductions. The NOx emissions reduction from all these programs were calculated using estimated emissions factors for 2009 from the US Environmental Protection Agency (US EPA) eGRID database, which had been specially prepared for this purpose.

In 2009, the cumulative total annual electricity savings from all programs is 25,585,081 MWh/year (15,327 tons-NOx/year). The total cumulative OSD electricity savings from all programs is 70,442 MWh/day, which would be a 2,935 MW average hourly load reduction during the OSD period (40.72 tons-NOx/day). By 2013, the total cumulative annual electricity savings from will be 31,979,929 MWh/year (19,314 tons-NOx/year). The total cumulative OSD electricity savings from all programs will be 92,099 MWh/day, which would be a 3,837 MW average hourly load reduction during the OSD period (54.15 tons-NOx/day).

The Laboratory has and will continue to provide leading-edge technical assistance to counties and communities working toward obtaining full SIP credit for the energy efficiency and renewable energy projects that are lowering emissions and improving the air for all Texans. The Laboratory will continue to provide superior technology to the State of Texas through efforts with the TCEQ and US EPA. The efforts taken by the Laboratory have produced significant success in bringing EE/RE closer to US EPA acceptance in the SIP.

[37] An ozone season day (OSD) represents the daily average emissions during the period that runs from mid-July to mid -September.

Table 9-1: Final Adjustment Factors used for the Calculation of the Annual and OSD NOx Savings for the Different Programs

	ESL-Single Family[16]	ESL-Multifamily[16]	ESL-Commercial[16]	Federal Buildings[15]	Furnace Pilot Light Program[15]	PUC (SB7)[15]	PUC (SB5 Grant Program)[15]	SECO[15]	Wind-ERCOT[8]	SEER13 Single Family
Annual Degradation Factor [11]	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%	5.00%
T&D Loss [9]	7.00%	7.00%	7.00%	7.00%	0.00%	7.00%	7.00%	7.00%	0.00%	7.00%
Initial Discount Factor [12]	20.00%	20.00%	20.00%	20.00%	20.00%	25.00%	25.00%	60.00%	25.00%	20.00%
Growth Factor	3.25%	1.54%	3.25%	0.00%	0.00%	0.00%	0.00%	0.00%	Actual Rates	N.A.
Weather Normalized	Yes	Yes	Yes	No	No	No	No	No	See note 7	Yes

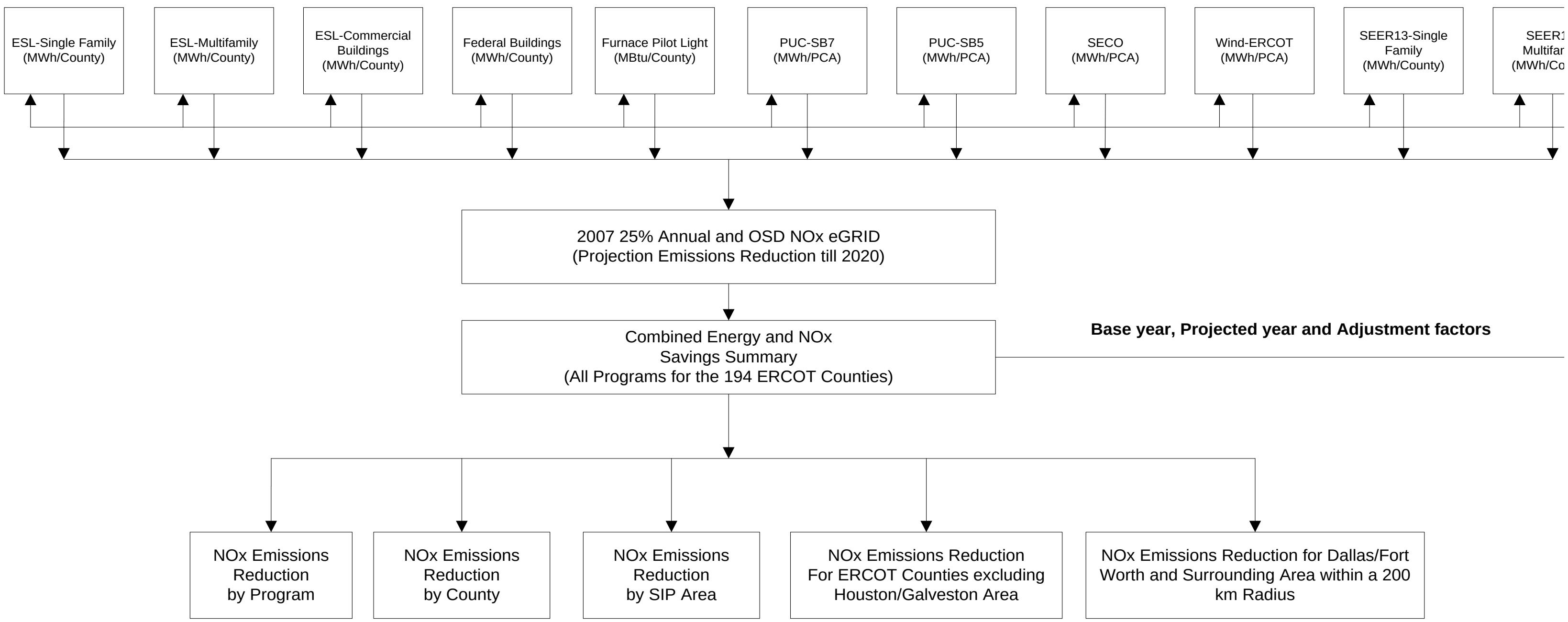


Figure 9-1: Process Flow Diagram of the NOx Emissions Reduction Calculations

Table 9-2: Example of NOx Emissions Reduction Calculations using eGRID

Area	County	American Electric Power - West (ERCOT) /PCA	NOx Reductions (lbs)	Austin Energy/PCA	NOx Reductions (lbs)	Brownsville Public Utils Board/PCA	NOx Reductions (lbs)	Lower Colorado River Auhotrity /PCA	NOx Reductions (lbs)	Reliant Energy HL&P/PCA	NOx Reductions (lbs)	San Antonio Public Service Bd/PCA	NOx Reductions (lbs)	South Texas Electric Coop INC/PCA	NOx Reductions (lbs)	Texas Municipal Power Pool/PCA	NOx Reductions (lbs)	Texas-New Mexico Power Co/PCA	NOx Reductions (lbs)	TXU Electric/PCA	NOx Reductions (lbs)	Total Nox Reductions (lbs)	Total Nox Reductions (Tons)
Houston-Galveston Area	Brazoria	0.008831132	226.0465792	0.010890729	8.193488679	0.006522185	0	0.003944232	14.32402746	0.065444292	3035.079423	0.014877434	272.3666894	0.006262315	0	0.004817148	0	0.121274957	139.7235344	0.00816387	940.7285451	4636.462287	2.318231144
	Chambers	0.021762222	557.0379581	0.026955801	20.27982242	0.016072371	0	0.009076193	32.96145962	0.164940225	7649.355979	0.037472294	686.0191605	0.015055623	0	0.009553214	0	0.011518588	13.2708178	0.015818592	1822.787617	10781.71281	5.390856407
	Fort Bend	0.070431234	1802.797078	0.087239726	65.63359654	0.052016606	0	0.029374182	106.6764342	0.533812376	24756.36787	0.121275295	2220.231709	0.048726002	0	0.030918012	0	0.037278747	42.94966114	0.051195276	5899.267979	34893.92432	17.44696216
	Galveston	0.033856739	866.6159501	0.041710519	31.3803294	0.025004711	0	0.015351589	55.75143316	0.249587379	11574.99759	0.056747051	1038.889275	0.024143087	0	0.019297151	0	0.567751219	654.118618	0.032836887	3783.817742	18005.57093	9.002785467
	Harris	0.068267332	1747.408655	0.084559408	63.61709594	0.050418468	0	0.028471701	103.3989497	0.517411736	23995.76304	0.117549281	2152.01819	0.047228963	0	0.029968099	0	0.03613341	41.63009278	0.049622373	5718.021208	33821.85723	16.91092861
	Liberty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Waller	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beaumont/ Port Arthur Area	Hardin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Jefferson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orange	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dallas/ Fort Worth Area	Collin	0.002039135	52.19483875	0.003716345	2.795940278	0.001505992	0	0.005950953	21.61171382	0.002481478	115.0823578	0.000717051	13.12731328	0.019166247	0	0.07668094	0	0.00086441	0.995905867	0.004000199	460.945804	666.7538738	0.333376937
	Dallas	0.004539471	116.1948312	0.004683963	3.523914222	0.003352602	0	0.00774211	28.1165509	0.002085611	96.72341896	0.00068106	12.46842352	0.007502816	0	0.026717045	0	0.007524933	8.669640256	0.040370454	4651.916039	4917.612818	2.458806409
	Denton	0.00047388	12.12970385	0.000872802	0.656640103	0.000349982	0	0.001396994	5.073377767	0.000585443	27.15083393	0.000168971	3.093405773	0.00454374	0	0.018187155	0	0.000186605	0.214992277	0.000849405	97.87758499	146.1965387	0.073098269
	Tarrant	0.012162492	311.3179263	0.012266309	9.228387517	0.008982543	0	0.020308652	73.75369976	0.005316504	246.5610524	0.001752506	32.08377752	0.017326428	0	0.060216761	0	0.020603444	23.73767965	0.110647237	12749.95959	13446.64211	6.723321056
	Ellis	0.003279814	83.95193355	0.003307809	2.488584531	0.002422289	0	0.005476558	19.88888265	0.001433682	66.48919108	0.000472592	8.651911537	0.004672353	0	0.016238427	0	0.005556053	6.401250735	0.029837824	3438.233618	3626.105373	1.813052686
	Johnson	0.000286058	7.322112154	0.000526868	0.396381687	0.000211267	0	0.000843297	3.062551359	0.000353404	16.38963767	0.000101999	1.867338584	0.002742835	0	0.010978701	0	0.000112645	0.129780379	0.000512745	59.08393672	88.25173856	0.044125869
	Kaufman	0.006325453	161.9098051	0.006379446	4.799487271	0.004671629	0	0.010562096	38.3577242	0.002765	128.2311379	0.000911441	16.68608752	0.009011105	0	0.031317452	0	0.010715411	12.34546025	0.057545265	6630.9817	6993.311403	3.496655701
	Parker	0.000217489	5.566981877	0.000400576	0.301367914	0.000160626	0	0.000641157	2.328449436	0.000268692	12.46099677	7.75498E-05	1.419732426	0.00208537	0	0.008347076	0	8.56434E-05	0.098671668	0.000389838	44.92135575	67.09755584	0.033548778
	Rockwall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Henderson	0.000819895	20.98648722	0.000826893	0.622101782	0.000605529	0	0.001369042	4.971866208	0.000358395	16.62111282	0.00011814	2.162823693	0.001168005	0	0.004059317	0	0.001388914	1.600198603	0.007458924	859.4971295	906.4617199	0.45323086
	Hood	0.01252711	320.6508812	0.012634039	9.505044007	0.009251829	0	0.020917482	75.96475123	0.005475887	253.9526704	0.001805044	33.04561243	0.017845854	0	0.062021991	0	0.021221112	24.4493081	0.113964315	13132.18878	13849.75705	6.924878523
	Hunt	0.006187558	158.3801895	0.006240374	4.694858985	0.004569788	0	0.010331844	37.5215301	0.002704724	125.4357135	0.000891572	16.32233268	0.008814664	0	0.030634735	0	0.010481817	12.0763306	0.056290785	6486.427041	6840.857996	3.420428998
El Paso Area	El Paso	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Antonio Area	Bexar	0.033413751	855.276978	0.051775843	38.95283667	0.024677545	0	0.090663423	329.2568536	0.001141841	52.95463998	1.143571754	20935.7914	0.046873844	0	0.004669544	0	0.000519582	0.598622181	0.002503865	288.5221599	22501.3535	11.25067675
	Comal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Guadalupe	0.002000467	51.20507169	0.076378745	57.46248772	0.001477434	0	0.133848731	486.0903138	0.001237133	57.37392999	0.003554796	65.07897116	0.001061766	0	0.001855699	0	0.000401718	0.462828487	0.001835165	211.4673431	929.140946	0.464570473
	Wilson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austin Area	Bastrop	0.004502334	115.2442433	0.171901148	129.3274415	0.003325174	0	0.301245466	1094.014881	0.002784342	129.1281298	0.008000571	146.4694129	0.002389654	0	0.004176513	0	0.000904124	1.041660856	0.004130298	475.937112	2091.162881	1.04558144
	Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hays	0.002458599	62.93167289	0.093870431	70.62211537	0.001815785	0	0.164501762	597.4110691	0.001520452	70.51327681	0.004368889	79.98286869	0.001304924	0	0.002280677	0	0.000493717	0.568821994	0.00225544	259.8960069	1141.925832	0.570962916
	Travis	0.000510007	13.05442349	0.299602906	225.4020851	0.000376663	0	0.033939476	123.2559365	0.000334709	15.52263338	0.000906121	16.58869273	0.000271138	0	0.000471744	0	0.000103327	0.119045148	0.000467336	53.85143207	447.7942484	0.223897124
	Williamson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North East Texas Area	Gregg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rusk	0.000685965	17.55833805	0.00069182	0.520481264	0.000506616	0	0.001145408	4.159710327	0.000299851	13.90604891	9.88414E-05	1.809525774	0.000977211	0	0.003396227	0	0.001162035	1.338805667	0.006240507	719.0980079	758.3909179	0.379195459
	Smith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Upshur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corpus Christi Area	Nueces	0.22756873	5824.975938	0.004556851	3.428283791	0.168069652	0	0.007612767	27.64682441	0.001680888	77.95375313	0.001626796	29.78235622	0.046792036	0	0.007246366	0	0.001609426	1.854254911	0.008283395	954.5014455	6920.142856	3.460071428
	San Patricio	0.050313351	1287.848557	0.001007478	0.757961986	0.037158653	0	0.001683113	6.112458369	0.000371629	17.2348572	0.00035967	6.584604794	0.010345288	0	0.001602105	0	0.000355829	0.409958691	0.001831382	211.0314828	1529.979881	0.76498994
Victoria Area	Victoria	0.021836736	558.9452467	0.002215582	1.666862472	0.016127403	0	0.003612695	13.12000619	0.001199621	55.63426979	0.000555389	10.16770824	0.52545648	0	0.032412721	0	0.000476855	0.549395481	0.002254849	259.8278678	899.9113567	0.449955678
Other ERCOT counties	Andrews	2.47421E-05	0.633312124	2.49533E-05	0.018773251	1.82731E-05	0	4.13138E-05	0.150036693	1.08153E-05	0.501577618	3.56511E-06	0.065267829	3.5247E-05	0	0.000122499	0	4.19135E-05	0.048289414	0.000225089	25.93716362	27.35442055	0.01367721
	Angelina	0.00031082	7.955919749	0.000313473	0.235837079	0.000229554	0	0.000519	1.884820844	0.000135867	6.301018286	4.47864E-05	0.81992053	0.000442787	0	0.001538876	0	0.000526534	0.606630902	0.002827658	325.8330045	343.6371519	0.171818576
	Bosque	0.000595392	15.23997933	0.001096604	0.825014503	0.000439723	0	0.001755208	6.374283599	0.000735562	34.11279889	0.000212298	3.88661097	0.005708837	0	0.02285067	0	0.000234455	0.270120186	0.001067208	122.9751683	183.6839758	0.091841988
	Brazos	0.001939725	49.65028649	0.003572622	2.687812467	0.001432574	0	0.005718288	20.7667609	0.002396384	111.1359931	0.000691644	12.66217912	0.018598805	0	0.074445136	0	0.000763829	0.880023807	0.003476855	400.6404605	598.4235164	0.299211758
	Calhoun	0.082699809	2116.830355	0.001655986	1.245858399	0.061077496	0	0.002766524	10.04701783	0.000610844	28.32885022	0.000591187	10.8230826	0.0170045	0	0.002633372	0	0.000584875	0.673847089	0.003010234	346.8714129	2514.820424	1.257410212
	Cameron	0.048371747	1238.150172	0.000968599	0.728712051	0.297964476	0	0.001618161	5.876577133	0.000357288	16.56975992	0.00034579	6.330503314	0.009946061	0	0.001540279	0	0.000342098	0.394138287	0.001760709	202.8877272	1470.93759	0.735468795
	Cherokee	0.003503899	89.68774747	0.003533808	2.658611083	0.002587786	0	0.00585073	21.24774271	0.001531635	71.03190513	0.00050488	9.243032581	0.00499158	0	0.017347879	0	0.005935657	6.838600793	0.031876422	3673.14266	3873.8503	1.93692515
	Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coleman	0.001298787	33.24447222	2.6007E-05	0.019566001	0.000959212	0	4.34478E-05	0.157786761	9.59321E-06	0.444899929	9.2845E-06	0.16997473	0.000267053	0	4.13567E-05	0	9.18536E-06	0.010582658	4.72752E-05	5.447558433	39.49484073	0.01974742
	Crockett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ector	0.003535748	90.50296541	0.003565928	2.682776563	0.002611307	0	0.005903911	21.44087434	0.001545556	71.67755054	0.00050947	9.327047245	0.005036951	0	0.017505563	0	0.00598961	6.900760344	0.032166163	3706.529738	3909.061712	1.954530856
	Fannin	0.007056315	180.6173605	0.007116546	5.354034748	0.005211403	0	0.011782473	42.78969328	0.003084477	143.0473568	0.001016752	18.61404924	0.010052276	0	0.034935966	0	0.011953503	13.77189259	0.064194222	7397.14566	7801.340048	3.900670024
	Fayette	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Freestone	0.003677178	94.12308402	0.003708565	2.790087625	0.00271576	0	0.006140067	22.29850932	0.001607379	74.54465257	0.000529848	9.700129134	0.005238429	0	0.018205785	0	0.006229194	7.176790757	0.033452809	3854.790927	4065.42418	2.03271209
	Frio	0.008588335	219.8317964	0.000871383	0.655572927	0.006342868	0	0.001420864	5.160066298	0.000471808	21.88082203	0.000218433	3.998934744	0.206660746	0	0.012747844	0	0.000187546	0.216075897	0.000886827	102.189664	353.9329323	0.176966466
	Grimes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hardeman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Haskell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hidalgo	0.188527456	4825.653746	0.003775086	2.840133709	0.139235931	0	0.006306735	22.9037859	0.001392518	64.58015017	0.001347706	24.6729498	0.03876448	0	0.006003193	0	0.001333316	1.536142338	0.006862311	790.7489276	5732.935836	2.866467918
	Howard	0.000555113	14.20898268	0.000559851	0.421196428	0.000409976	0	0.000926915	3.366221326	0.000242653	11.25338899	7.99868E-05	1.464348181	0.000790802	0	0.002748377	0	0.00094037	1.083420679	0.005050094	581.9258697	613.723428	0.306861714
	Jack	0.002121449	54.30177924	0.002139557	1.609665938	0.001566784	0	0.003542346	12.86452461	0.000927334	43.00653033	0.000305682	5.596228347	0.00302217	0	0.010503338	0	0.003593766	4.140456206	0.019299698	2223.917843	2345.437027	1.172718514
	Jones	0.040718722	1042.259088	0.000815354	0.613420549	0.030072592	0	0.001362147	4.946827986	0.00030076	13.94821343	0.000291082	5.32893728	0.008372468	0	0.001296587	0	0.000287974	0.331780603	0.001482142	170.7883116	1238.216579	0.61910829
	Lamar	0.000950838	24.33817497	0.000958954	0.721455757	0.000702236	0	0.001587687	5.765907769	0.000415633	19.27561996	0.000137007	2.508241656	0.001354543	0	0.004707619	0	0.001610734	1.855761432	0.008650166	996.7647898	1051.229951	0.525614976
	Limestone	0.000719757	18.42329542	0.000891528	0.670728366	0.000531572	0	0.000300183	1.090156782	0.00545518	252.9923553	0.001239347	22.68917849	0.000497945	0	0.00031596	0	0.000380962	0.438914787	0.000523179	60.28629516	356.5909243	0.178295462
	Llano	0.001238174	31.69299001	0.047274044	35.56597012	0.000914447	0	0.082844655	300.8619059	0.000765714	35.51115798	0.002200214	40.28013466	0.000657172	0	0.001148571	0	0.000248641	0.286464175	0.001135861	130.8861051	575.0847279	0.287542364
	McLennan	0.024534317	627.9940467	0.024743738	18.61560781	0.018119687	0	0.040966843	148.7767984	0.010724513	497.3657473	0.003535175	64.71975936	0.034951066	0	0.121469933	0	0.041561501	47.88391622	0.22319886	25719.36288	27124.71876	13.56235938
	Milam	0.002245405	57.4746346	0.002264571	1.703718789	0.001658332	0	0.003749326	13.61619935	0.000981518	45.51940379	0.000323543	5.923216216	0.003198756	0	0.011117048	0	0.00380375	4.382383245	0.02042738	2353.86146	2482.481016	1.241240508
	Mitchell	0.014943169	382.493668	0.015070721	11.3382478	0.011036196	0	0.024951762	90.61580067	0.006532002	302.9316123	0.002153177	39.41900132	0.02128772	0	0.07398395	0	0.025313952	29.16475857	0.135944204	15664.94698	16520.91007	8.260455036
	Nolan	0.000564654	14.45319062	0.000569473	0.428435476	0.000417022	0	0.000942846	3.424076134	0.000246823	11.44679952	8.13615E-05	1.489515743	0.000804394	0	0.002795613	0	0.000956532	1.102041289	0.005136889	591.9273539	624.2714127	0.312135706
	Palo Pinto	0.003206998	82.08811543	0.005906709	4.443830552	0.002368511	0	0.009454195	34.33422818	0.003962005	183.7440401	0.001143513	20.93471146	0.030749889	0	0.123082087	0	0.001262858	1.454966345	0.005748375	662.3893373	989.3892293	0.494694615
	Pecos	4.09677E-05	1.048631523	4.13174E-05	0.031084551	3.02565E-05	0	6.84069E-05	0.248429171	1.79079E-05	0.830506919	5.90308E-06	0.108069782	5.83617E-05	0	0.000202832	0	6.93999E-05	0.079957102	0.0003727	42.94648142	45.29316047	0.02264658
	Presidio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Robertson	0.000737708	18.88277792	0.000835096	0.628273174	0.00054483	0	0.000735917	2.67258533	0.003149678	146.0711407	0.000730875	13.38040458	0.00076086	0	0.001866305	0	0.191632518	220.7840225	0.003397737	391.5236901	793.9428943	0.396971447
	Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titus	0.005696437	145.8091831	0.005745061	4.322217039	0.004207073	0	0.009511781	34.54335843	0.002490043	115.4795873	0.000820806	15.02679093	0.008115023	0	0.028203184	0	0.00964985	11.11780398	0.051822854	5971.584145	6297.883086	3.148941543
	Tom Green	0.001482448	37.94556586	2.96846E-05	0.022332825	0.001094854	0	4.95918E-05	0.180099353	1.09498E-05	0.507813132	1.05974E-05	0.19401082	0.000304817	0	4.72049E-05	0	1.04843E-05	0.012079149	5.39604E-05	6.217896494	45.07979763	0.022539899
	Upton	3.11661E-05	0.797745539	3.14322E-05	0.023647546	2.30176E-05	0	5.20405E-05	0.188992281	1.36234E-05	0.631807433	4.49076E-06	0.082213995	4.43986E-05	0	0.000154304	0	5.27959E-05	0.060827297	0.000283531	32.67149923	34.45673333	0.017228367
	Ward	0.018559529	475.0600294	0.01871795	14.08218954	0.013707039	0	0.030990277	112.54551	0.008112796	376.2433542	0.002674262	48.95869786	0.026439509	0	0.091888626	0	0.03144012	36.22285079	0.16884373	19455.98267	20519.0953	10.25954765
	Webb	0.020014327	512.2978652	0.000400768	0.301512399	0.014781473	0	0.000669531	2.431496589	0.000147832	6.855915242	0.000143074	2.619313398	0.004115289	0	0.000637307	0	0.000141547	0.163078928	0.000728512	83.94696529	608.6161471	0.304308074
	Wharton	0.00014434	3.694599265	0.000178787	0.134507561	0.000106601	0	6.01986E-05	0.218619544	0.001093979	50.7349716	0.000248538	4.550077512	9.98576E-05	0	6.33625E-05	0	7.6398E-05	0.088019771	0.000104918	12.08978615	71.5105814	0.035755291
	Wichita	0.000207633	5.314695266	0.000209406	0.157543345	0.000153346	0	0.000346701	1.259093698	9.07612E-05	4.209191786	2.99181E-05	0.547721432	0.00029579	0	0.001027996	0	0.000351734	0.405240184	0.001888925	217.6622165	229.5557022	0.114777851
	Wilbarger	0.028616818	732.4920115	0.000573025	0.431107444	0.021134796	0	0.000957307	3.476594279	0.000211372	9.802701684	0.00020457	3.745137877	0.005884109	0	0.000911232	0	0.000202386	0.233172965	0.001041639	120.0287677	870.2094935	0.435104747
	Wise	0.002844488	72.80908734	0.002882008	2.16823872	0.002100781	0	0.00476997	17.32281236	0.001256075	58.25242144	0.000413241	7.565361234	0.004181914	0	0.014614274	0	0.004797945	5.527817073	0.025761411	2968.505674	3132.151412	1.566075706
	Young	0.006235856	159.6164509	0.006289085	4.731505443	0.004605458	0	0.010412491	37.81441029	0.002725836	126.4148216	0.000898531	16.44979321	0.008883468	0	0.030873859	0	0.010563634	12.17059429	0.056730171	6537.057865	6894.255386	3.447127693
	Total	**1.121837219**	**28715.17018**	**1.172570094**	**882.1668247**	**1.090766584**	**0**	**1.189130767**	**4318.494059**	**1.629360006**	**75564.06999**	**1.542362643**	**28236.60382**	**1.359385821**	**0**	**1.231642808**	**0**	**1.221806085**	**1407.669558**	**1.528786947**	**176163.2035**	**315287.3779**	**157.643689**
Energy Savings by PCA (MWh)		25,597		752		0		3,632		46,377		18,307		0		0		1,152		115,231			

Table 9-3: Annual and OSD Electricity Savings for the Different Programs

PROGRAM	ANNUAL															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	225,389	1,001,051	1,197,537	1,256,764	1,252,530	1,247,084	1,240,311	1,232,099	1,222,335	1,210,907	1,197,702	1,182,608	1,165,511	1,146,299	1,124,859	1,101,079
ESL-Multifamily (MWh)	9,228	37,821	51,312	63,156	165,765	264,701	359,882	451,226	538,652	622,078	701,421	776,601	847,536	914,144	976,342	1,034,050
ESL-Commercial (MWh)	63,456	129,063	192,036	231,649	270,392	308,184	344,944	380,592	415,047	448,228	480,055	510,445	539,320	566,597	592,196	616,037
Federal Buildings (MWh)	52,276	109,073	159,415	206,960	251,708	293,659	332,813	369,171	402,732	433,496	461,464	486,635	509,009	528,586	545,366	559,350
Furnace Pilot Light Program (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904
PUC (SB7) (MWh)	302,192	1,362,701	1,630,383	2,003,432	2,336,446	2,647,008	2,935,118	3,200,777	3,443,984	3,664,739	3,863,043	4,038,895	4,192,295	4,323,244	4,431,741	4,517,786
PUC (SB5 grant program) (MWh)	0	13,633	12,827	12,021	11,215	10,409	9,603	8,797	7,991	7,186	6,380	5,574	4,768	3,962	3,156	2,350
SECO (MWh)	115,360	293,764	353,701	445,357	457,921	468,611	477,428	484,371	489,440	492,636	493,959	493,408	490,983	486,685	480,513	472,468
Wind-ERCOT (MWh)	2,867,049	6,699,696	9,193,504	15,171,518	18,808,351	20,647,822	21,127,684	21,767,500	22,426,692	23,105,846	23,805,568	24,526,479	25,269,222	26,034,457	26,822,866	27,635,151
SEER13-Single Family (MWh)	0	374,246	624,639	913,010	1,185,311	1,441,594	1,681,860	1,906,108	2,114,339	2,306,551	2,482,746	2,642,923	2,787,083	2,915,224	2,803,568	2,590,509
SEER13-Multifamily (MWh)	0	31,634	52,532	76,375	98,620	119,281	138,371	155,904	171,894	186,354	199,298	210,738	220,690	229,165	219,722	202,900
Total Annual (MWh)	3,634,949	10,052,682	13,467,885	20,380,240	24,838,258	27,448,353	28,648,015	29,956,546	31,233,107	32,478,022	33,691,635	34,874,306	36,026,415	37,148,362	38,000,330	38,731,679
Total Annual (MMBtu)	2,209,050	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904	2,548,904

PROGRAM	OZONE SEASON DAY - OSD															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family (MWh)	776	5,537	6,519	6,904	6,981	7,227	7,274	7,312	7,338	7,353	7,356	7,346	7,322	7,284	7,230	7,160
ESL-Multifamily (MWh)	36	192	271	351	829	1,295	1,738	2,162	2,568	2,956	3,324	3,673	4,001	4,310	4,598	4,865
ESL-Commercial (MWh)	0	800	1,189	1,447	1,700	1,966	2,205	2,436	2,660	2,876	3,082	3,280	3,467	3,645	3,811	3,967
Federal Buildings (MWh)	0	299	437	567	690	805	912	1,011	1,103	1,188	1,264	1,333	1,395	1,448	1,494	1,532
Furnace Pilot Light Program (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983
PUC (SB7) (MWh)	828	3,733	4,467	5,489	6,401	7,252	8,041	8,769	9,436	10,040	10,584	11,065	11,486	11,845	12,142	12,377
PUC (SB5 grant program) (MWh)	0	37	35	33	31	29	26	24	22	20	17	15	13	11	9	6
SECO (MWh)	316	805	969	1,220	1,255	1,284	1,308	1,327	1,341	1,350	1,353	1,352	1,345	1,333	1,316	1,294
Wind-ERCOT (MWh)	5,836	14,936	20,763	25,575	41,403	45,453	46,509	47,918	49,369	50,864	52,404	53,991	55,626	57,310	59,046	60,834
SEER13-Single Family (MWh)	0	2,666	4,449	6,503	8,442	10,268	11,979	13,576	15,059	16,428	17,683	18,824	19,851	20,764	19,969	18,451
SEER13-Multifamily (MWh)	0	213	354	514	664	803	931	1,049	1,157	1,254	1,341	1,418	1,485	1,542	1,479	1,365
Total Annual (MWh)	7,791	29,219	39,453	48,602	68,396	76,381	80,924	85,585	90,053	94,328	98,410	102,298	105,992	109,492	111,093	111,853
Total Annual (MMBtu)	5,819	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983	6,983

Table 9-4: Annual and OSD NOx Emissions Reduction Values for the Different Programs

PROGRAM	ANNUAL (in tons NOx)															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	158	708	843	883	879	874	869	862	854	845	835	823	810	796	780	762
ESL-Multifamily	6	26	35	44	119	191	261	328	392	453	511	566	618	667	712	755
ESL-Commercial	44	90	136	164	192	218	245	270	295	319	341	363	384	403	421	438
Federal Buildings	40	84	122	158	193	225	255	283	308	332	353	373	390	405	418	428
Furnace Pilot Light Program	102	117	117	117	117	117	117	117	117	117	117	117	0	0	0	0
PUC (SB7)	237	1,074	1,157	1,421	1,633	1,830	2,012	2,179	2,332	2,471	2,594	2,703	2,797	2,876	2,941	3,367
PUC (SB5 grant program)	0	6	5	5	5	4	4	4	3	3	3	2	2	2	1	1
SECO	67	224	270	340	349	357	364	369	373	376	377	376	374	371	366	360
Wind-ERCOT	2,465	4,152	5,688	8,914	10,957	12,029	12,308	12,681	13,065	13,461	13,868	14,288	14,721	15,167	15,626	16,099
SEER13-Single Family	0	258	430	629	816	993	1,158	1,313	1,456	1,589	1,710	1,820	1,920	2,008	1,931	1,784
SEER13-Multifamily	0	22	36	53	68	82	95	107	118	128	137	145	152	158	151	140
Total Annual (Tons NOx)	3,119	6,760	8,839	12,727	15,327	16,921	17,688	18,513	19,314	20,092	20,846	21,577	22,167	22,852	23,348	24,135

PROGRAM	OZONE SEASON DAY - OSD (in tons NOx/day)															
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ESL-Single Family	0.76	3.85	4.50	4.76	4.81	4.98	5.00	5.02	5.04	5.04	5.04	5.03	5.01	4.98	4.94	4.89
ESL-Multifamily	0.03	0.13	0.18	0.24	0.58	0.92	1.24	1.55	1.84	2.12	2.39	2.64	2.88	3.11	3.31	3.51
ESL-Commercial	0.26	0.55	0.82	1.00	1.17	1.36	1.52	1.68	1.84	1.98	2.13	2.26	2.39	2.52	2.63	2.74
Federal Buildings	0.11	0.22	0.32	0.42	0.51	0.59	0.67	0.74	0.81	0.87	0.93	0.98	1.02	1.06	1.10	1.12
Furnace Pilot Light Program	0.28	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.00	0.00	0.00	0.00
PUC (SB7)	0.64	2.61	3.10	3.81	4.38	4.91	5.40	5.85	6.27	6.64	6.97	7.26	7.52	7.73	7.91	8.04
PUC (SB5 grant program)	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
SECO	0.18	0.61	0.73	0.92	0.95	0.97	0.99	1.00	1.01	1.02	1.02	1.02	1.02	1.01	0.99	0.98
Wind-ERCOT	5.85	9.27	12.98	15.13	21.79	23.93	24.48	25.22	25.99	26.77	27.59	28.42	29.28	30.17	31.08	32.02
SEER13-Single Family	0.00	1.81	3.03	4.42	5.74	6.98	8.15	9.23	10.24	11.17	12.03	12.80	13.50	14.12	13.58	12.55
SEER13-Multifamily	0.00	0.15	0.24	0.35	0.45	0.55	0.63	0.71	0.79	0.85	0.91	0.97	1.01	1.05	1.01	0.93
Total OSD (Tons NOx)	8.09	19.53	26.24	31.38	40.72	45.51	48.42	51.35	54.15	56.81	59.33	61.72	63.64	65.75	66.55	66.78

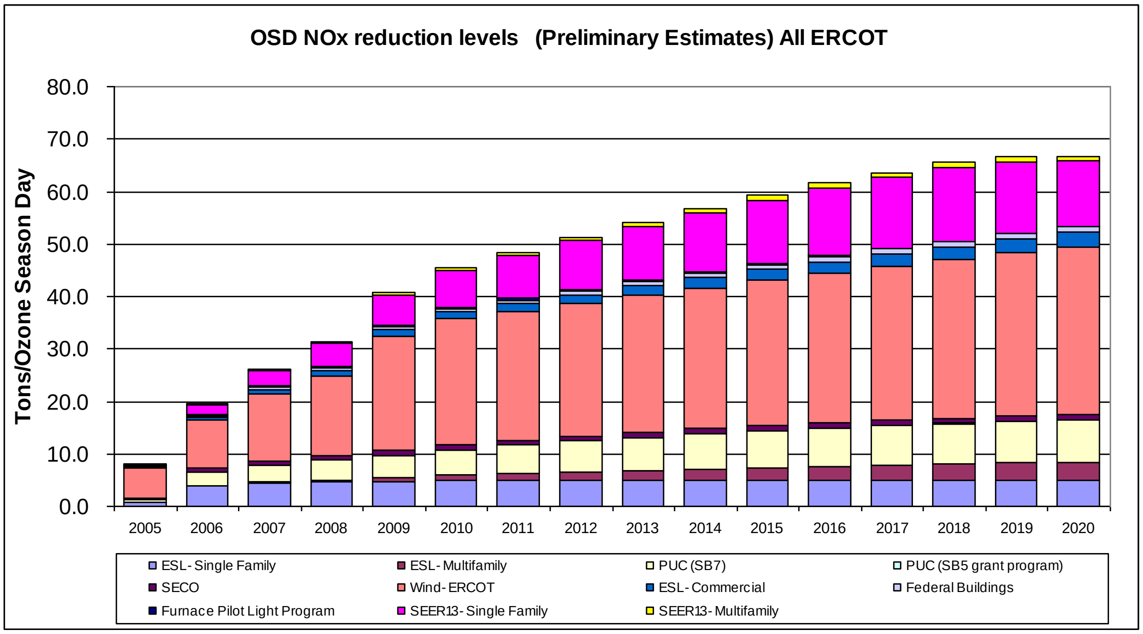


Figure 9-2: Cumulative OSD NOx Emissions Reduction Projections through 2020

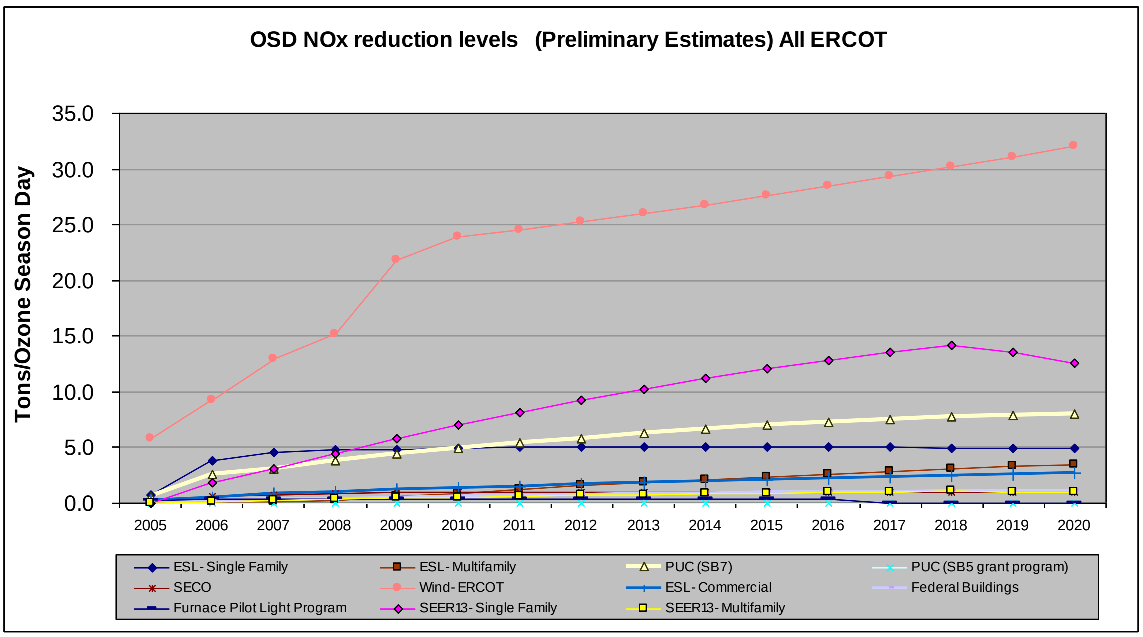


Figure 9-3: Cumulative OSD NOx Emissions Reduction Projections through 2020

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10 APPENDIX A

10.1 Presentation to EPA Sustainable Skylines, Dallas (March 2009)

In March of 2009, the Energy Systems Lab made a presentation to the EPA Sustainable Skylines about the quantification of energy and emissions saved in programs in Texas in Dallas, Texas.

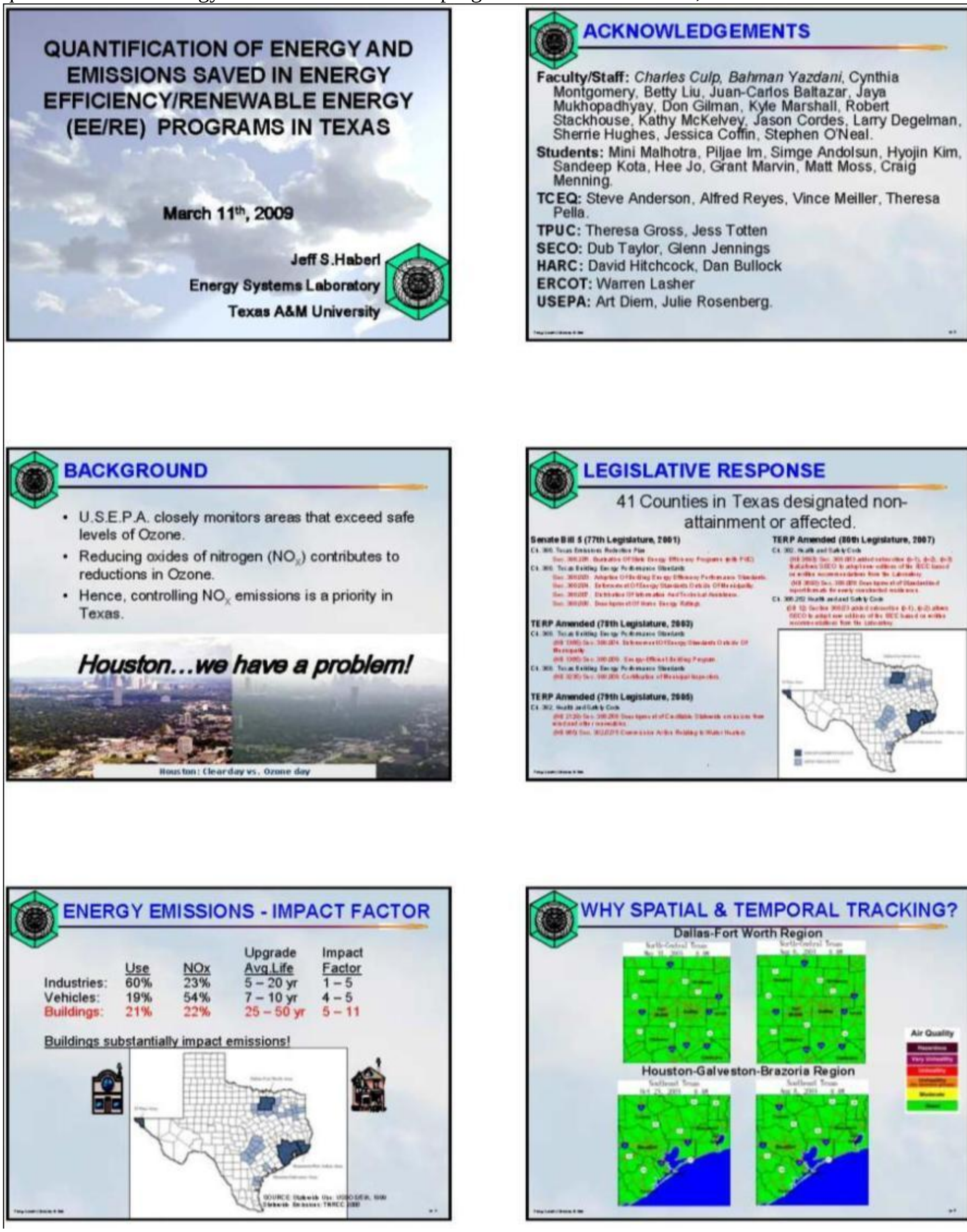
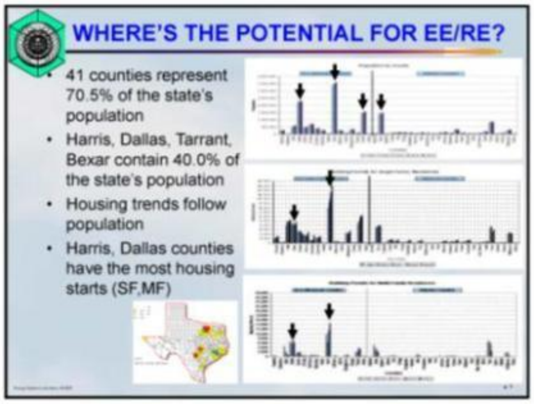
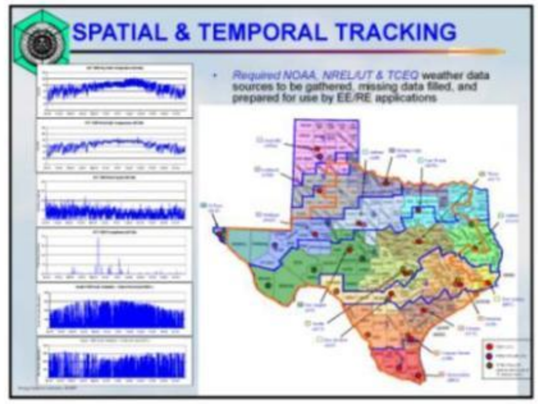
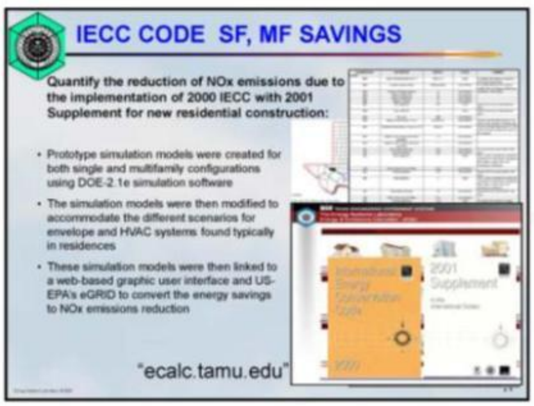
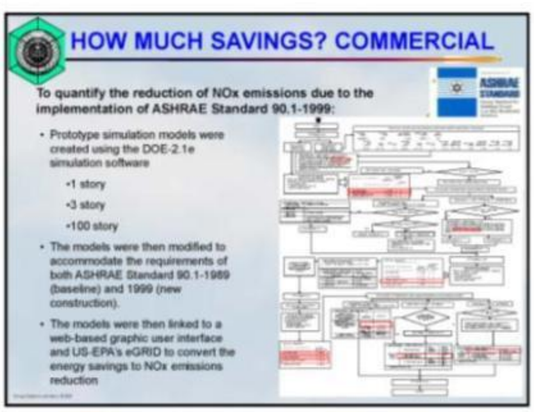


Figure 10-1: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 1)









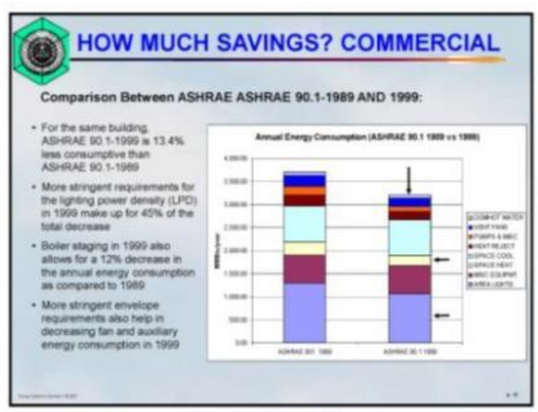
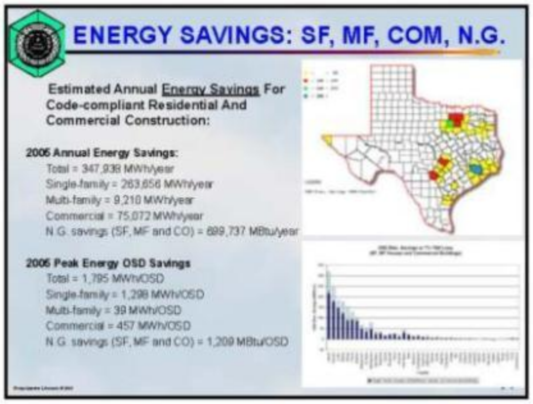
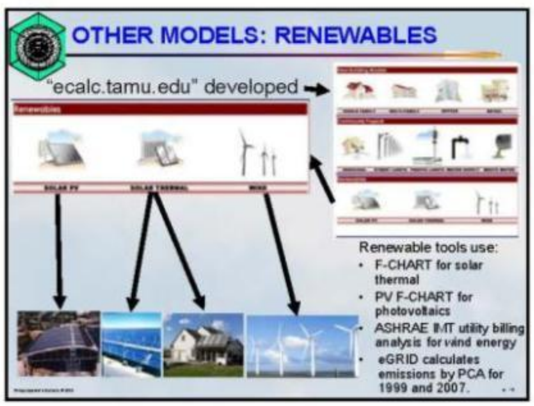
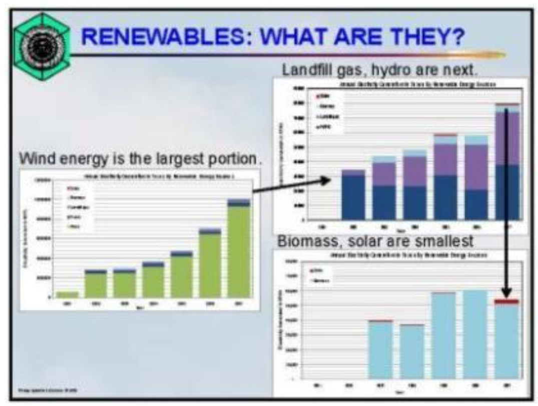
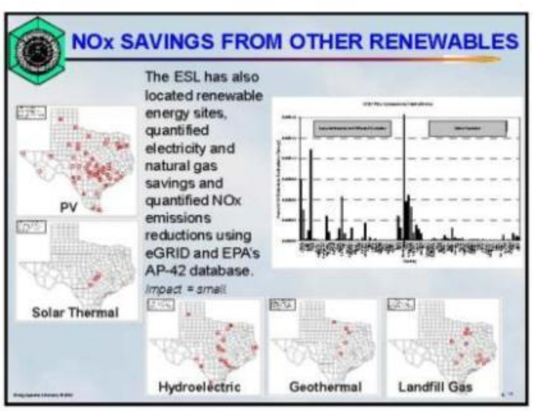


Figure 10-2: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 2)









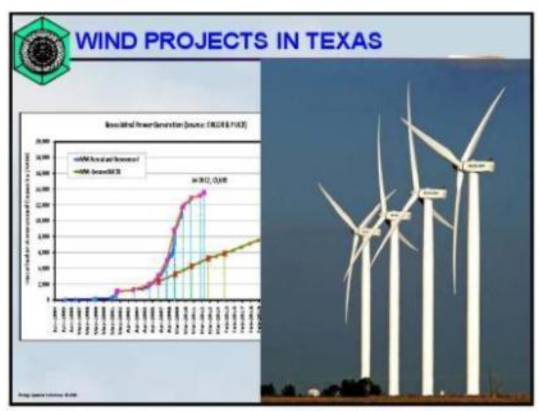


Figure 10-3: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 3)

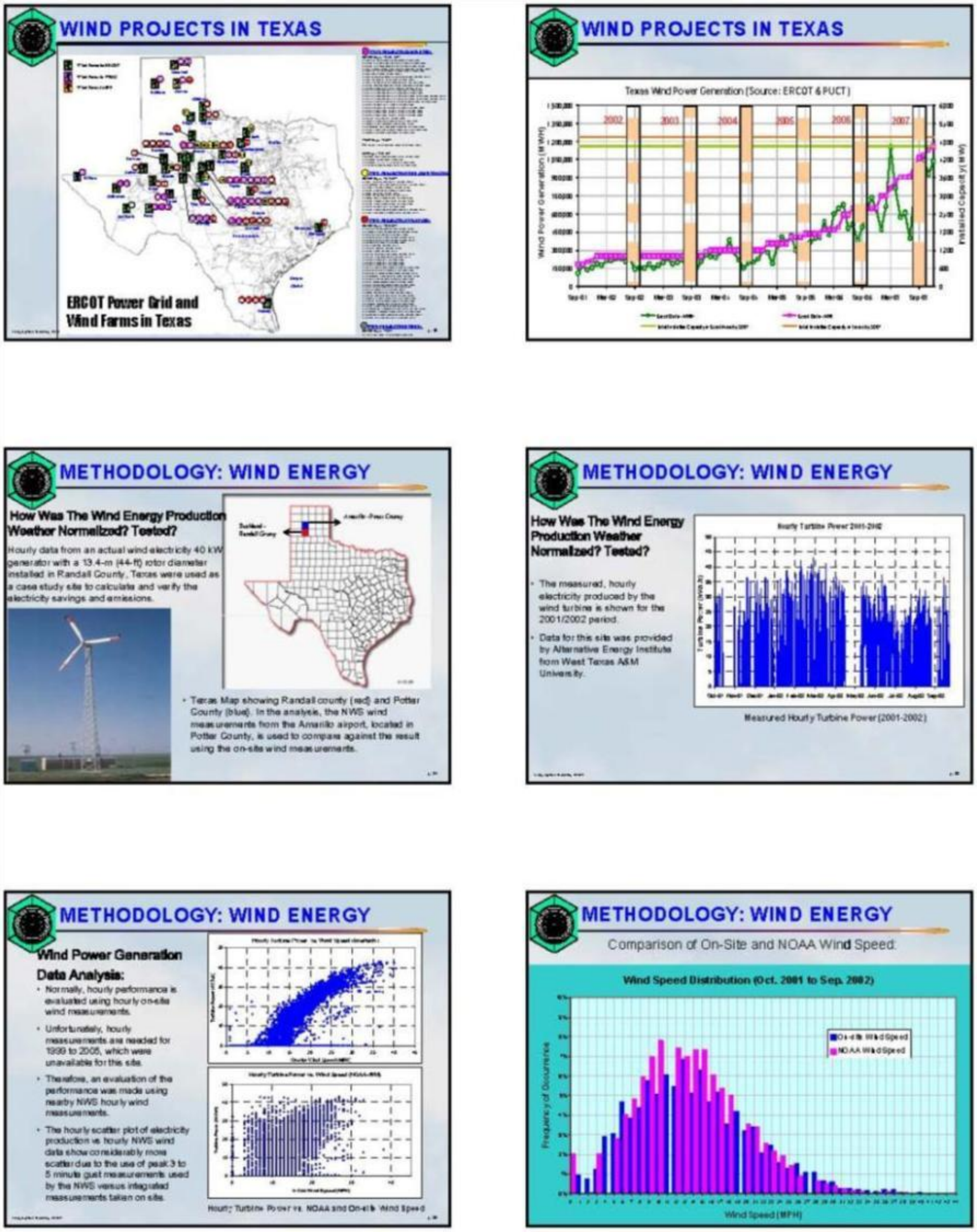
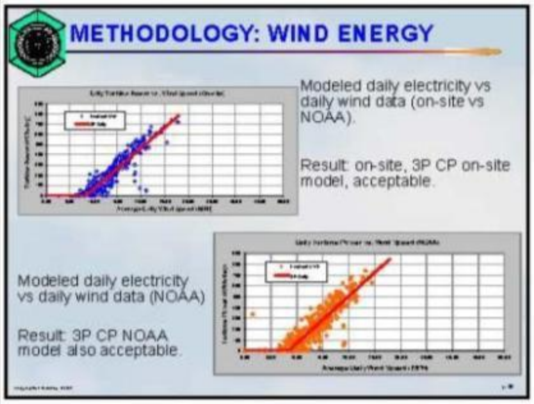
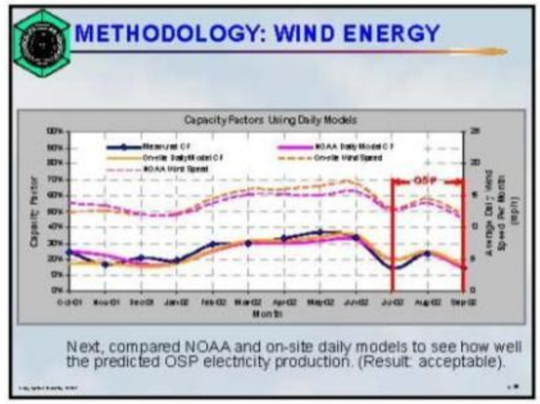
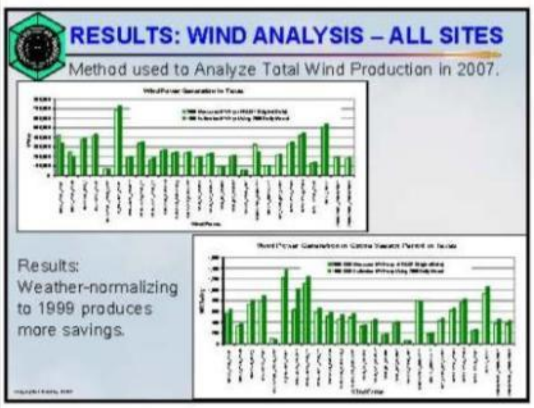
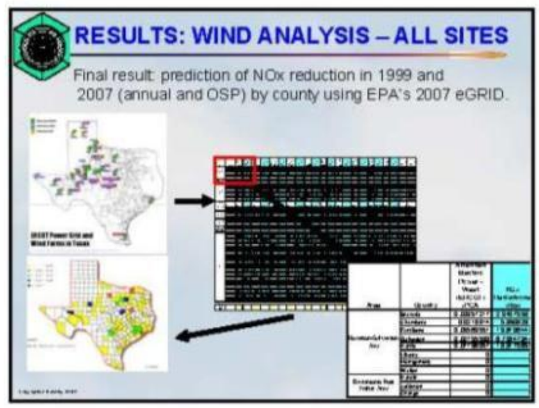


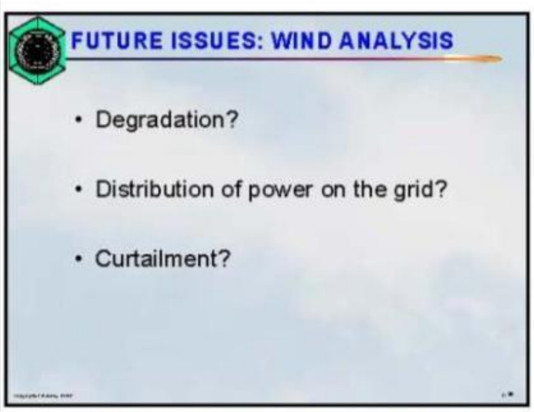
Figure 10-4: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 4)











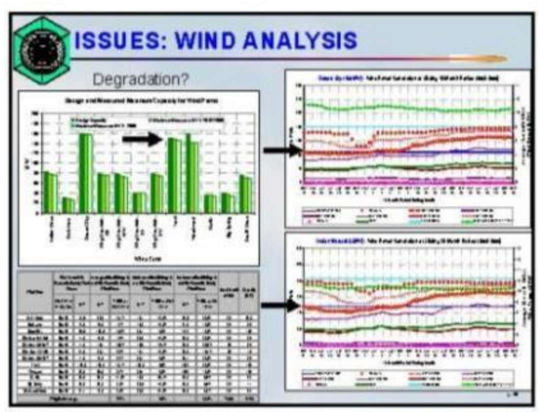
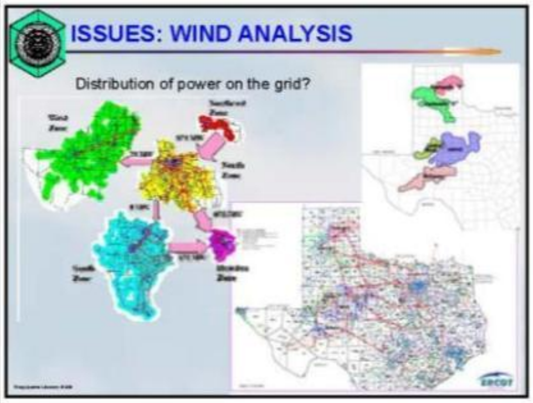
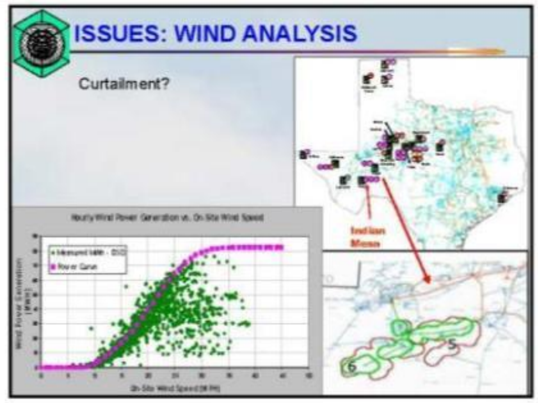
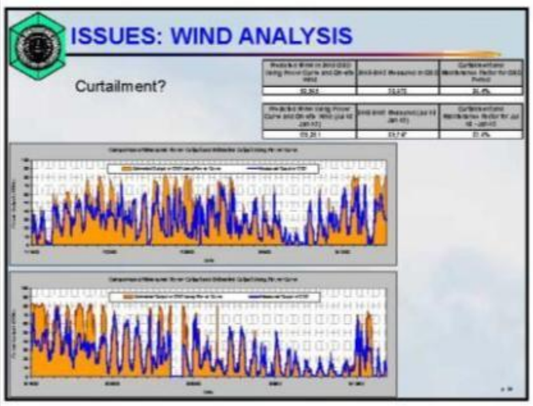
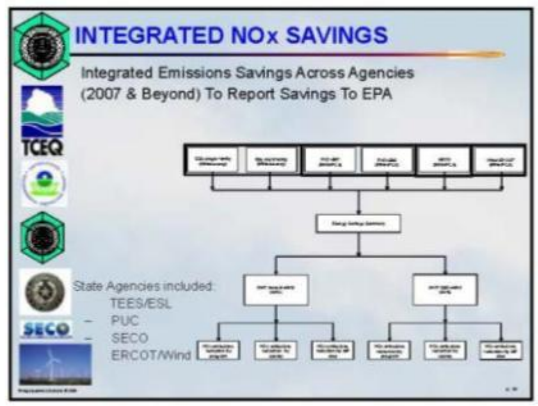


Figure 10-5: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 5)









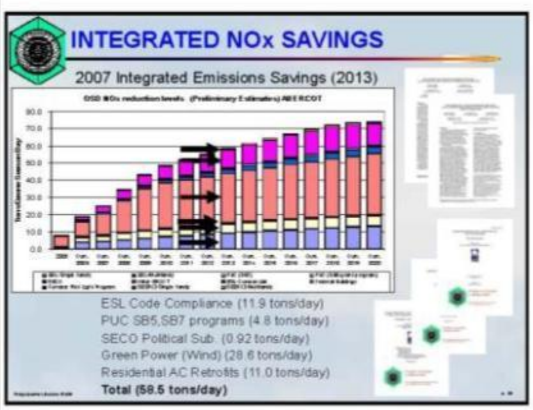


Figure 10-6: Presentation to EPA Sustainable Skylines, Dallas (March 2009) (Part 6)

10.2 Presentation to the Texas Senate and Energy Efficiency Committee, Austin (March 2009)

In March of 2009, the Energy Systems Lab made a presentation to the Texas Senate and Energy Efficiency Committee about CO_2 Emissions Reduction Potential in Austin, Texas.

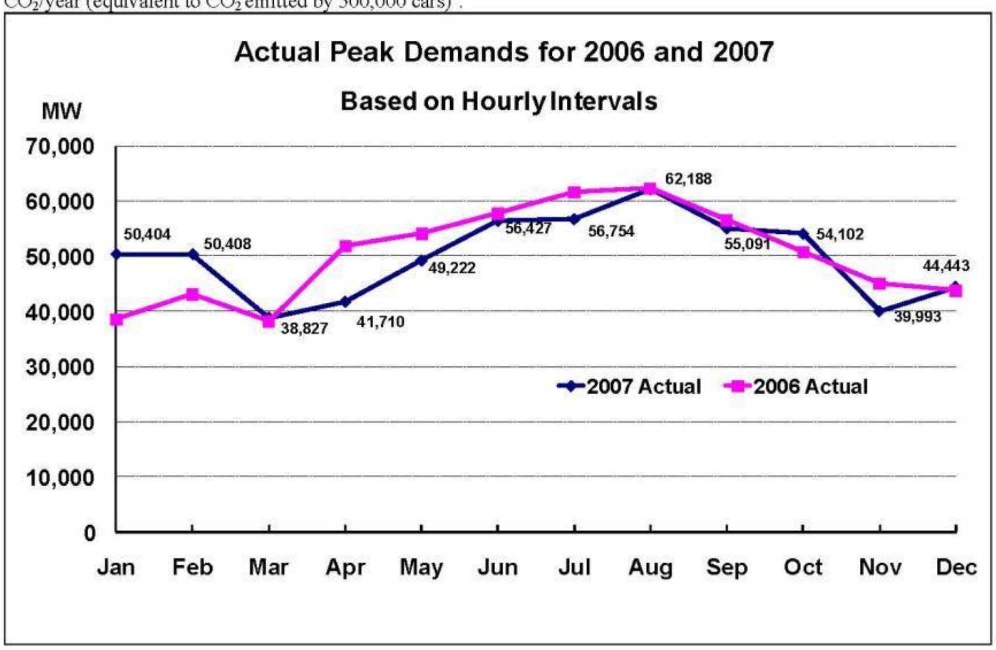
C02 Emissions Reduction Potential From a 1% to 5% ERCOT-wide Peak Electric Demand Reduction

The potential electricity and CO_2 emissions reductions from a 1% to 5% peak electric demand reduction across the ERCOT region during peak periods can be estimated as follows. In the figure below the actual ERCOT peak monthly demands[1] are shown for 2006 and 2007. From these data if one assumes the peak demand using August of 2007 (i.e., 62,188 MW), a 1% to 5% demand reduction could be 622 MW to 3,110 MW.

Using the MWh to CO_2 conversion values from the 2007 edition of the USEPA's eGRID database[2], and proportioning the electricity sales data in the ERCOT region according to the published electricity sales data for Texas in 1998[3], the CO_2 emissions reduction from one hour of electricity savings of 622 MWh to 3,110 MWh could be as much as 388.3 to 1,941.6 tons-CO_2.

If the peak demand reduction were to continue for a four hour period, for example from 12:00 Noon to 4:00 PM, the electricity reduction could be 2,488 to 12,440 MWh, with a corresponding CO_2 emissions reduction of 1,553 to 7,766 tons-CO_2/day. By comparison, in 2005 it was estimated[4] that the average daily electricity savings from the code-compliant new construction for single family residential during an ozone season day (OSD) was 776 MWh, with a corresponding CO_2 emissions reduction of 485 tons-CO_2/day.

If these peak electric demand reductions could be continued throughout the year the electricity reduction could be 908,120 to 4,540,600 MWh/year with a corresponding CO_2 emissions reduction of 566,941 to 2,834,708 tons-CO_2/year (equivalent to CO_2 emitted by 500,000 cars)[5].



[1] Data obtained from ERCOT - File Name: ERCOT2007D&E011108.xls (Updated 01/16/2008).

[2] This is a special version of eGRID developed by the EPA for the TCEQ that reflects the 2007 electricity and pollution from electric utilities in ERCOT during the 1998 to 1999 period based on selected growth assumptions for 2007.

[3] Electricity was proportioned according to the TPUC total sales for 1998 by Power Control Authority as follows: AEP (11.2%), Austin Energy (1.3%), Brownsville Public Power (0.1%), LCRA (4.1%), Reliant (35.2%), San Antonio Public Power (4.9%), Texas Municipal Power (3.0%), Texas-New Mexico Power (3.5%), TXU (35.7%).

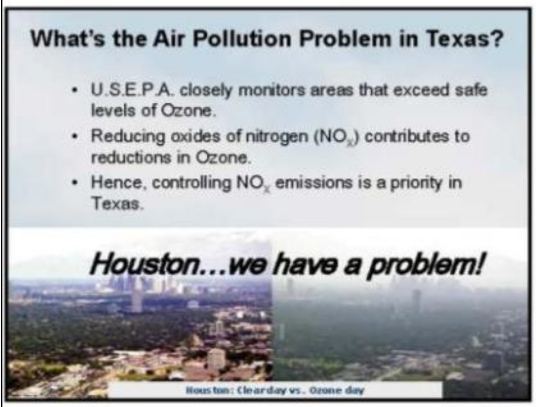
[4] Haberl, J., Culp, C., Yazdani, B., Gilman, D., Liu, Z., Baltazar, J., Montgomery, C., McKelvey, K, Mukhopadyay, J., Degelman, L. 2008. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP): Preliminary Report to the TCEQ", Energy Systems Laboratory ESL-TR-08-08-01, Texas A&M University System, p. 15 (August).

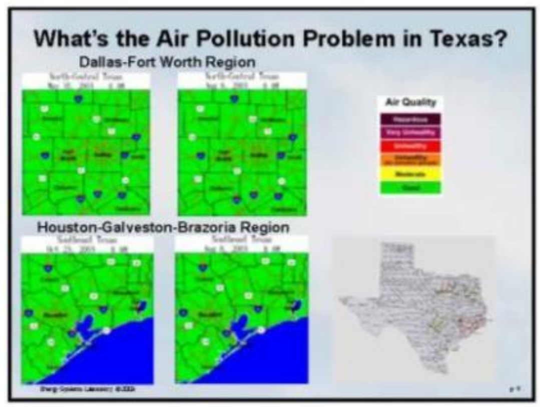
[5] These estimates assume that the electricity reductions during the peak demand periods are actual electricity reductions and not peak shifting. In addition, this estimate assumes that no other form of non-renewable energy is consumed to off-set the peak electricity reductions.

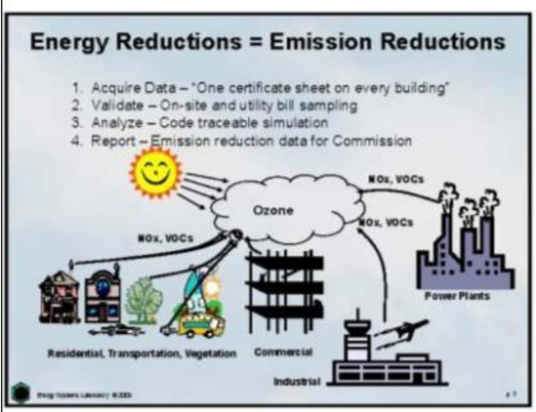
Figure 10-7: Presentation to the Texas Senate and Energy Efficiency Committee, Austin (March 2009)

10.3 Presentation to IBPSA, Glasgow, Scotland (July 2009)

In July of 2009, Dr. Jeff Haberl made a presentation at the International Building Simulation Association about the development of a web-based code-compliant 2001 IECC residential simulator for Texas in Glasgow, Scotland.







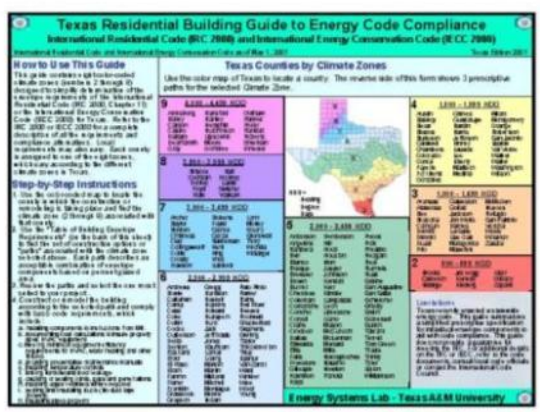
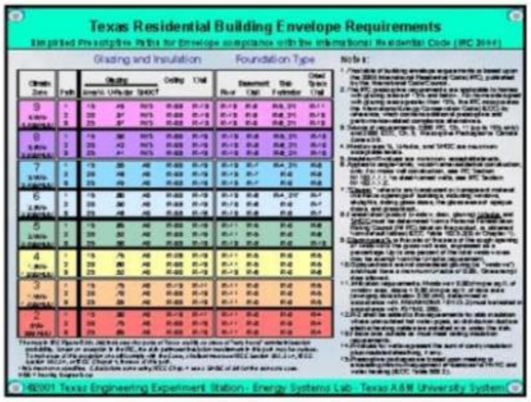
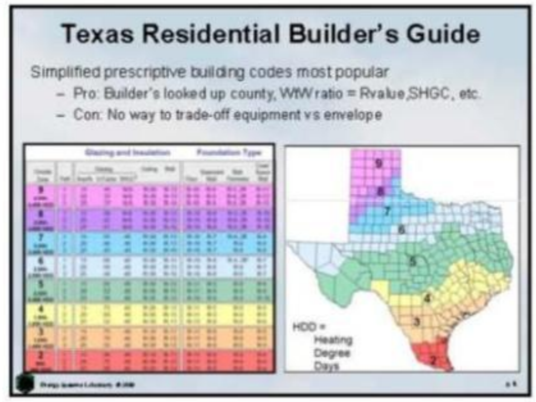
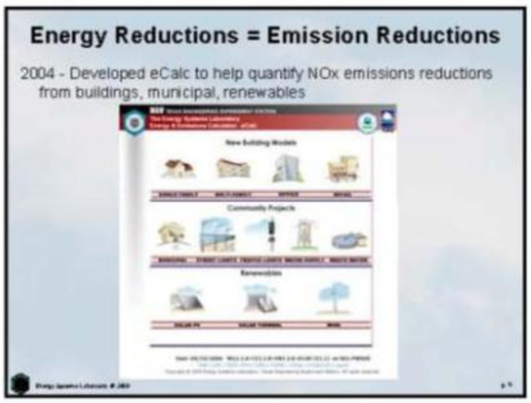
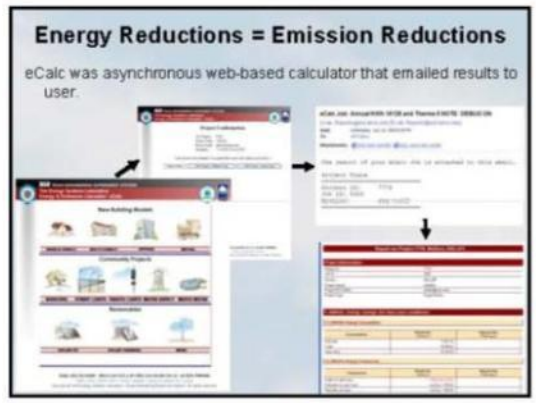


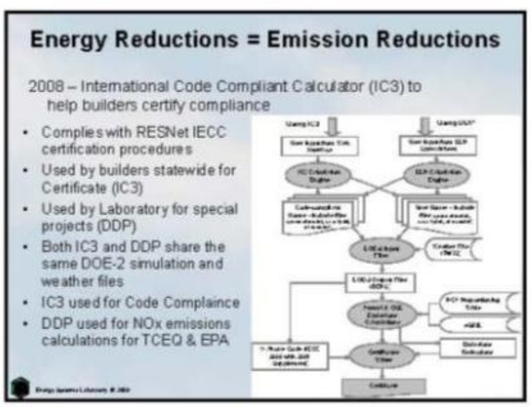
Figure 10-8: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 1)











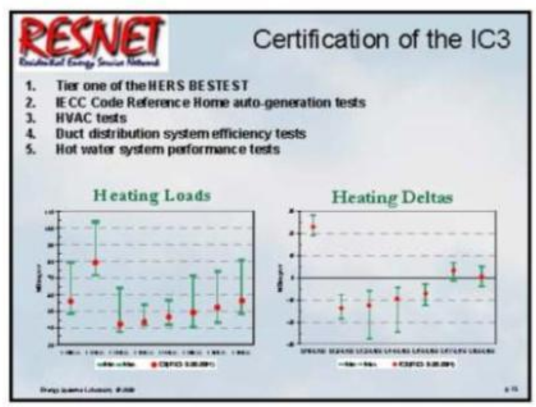
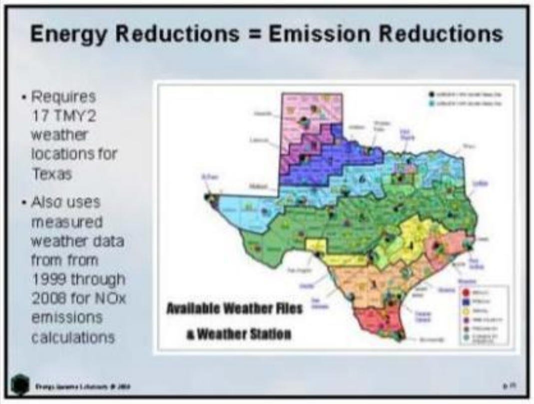
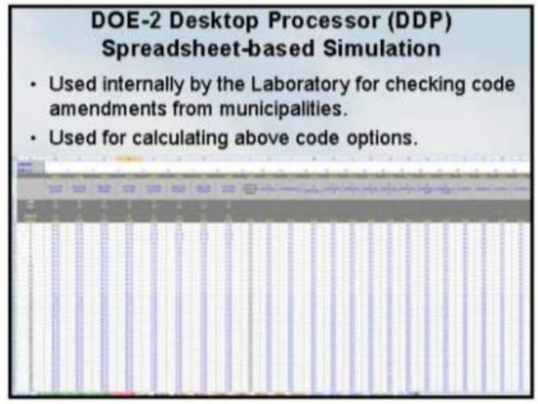
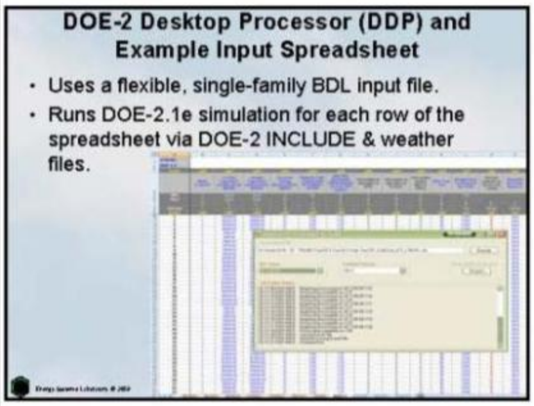
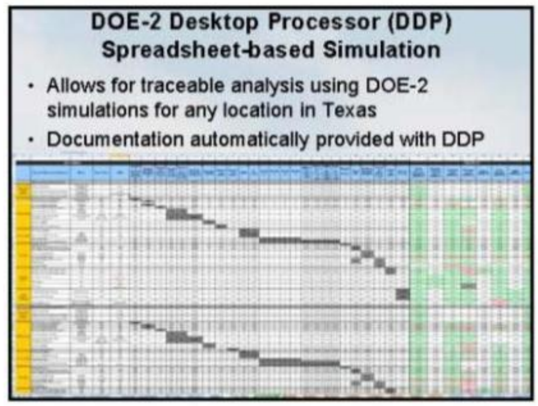


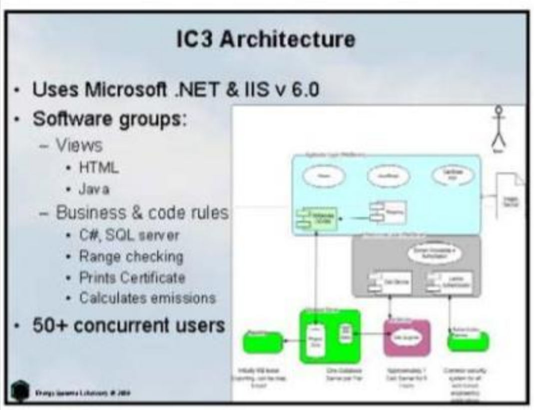
Figure 10-9: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 2)











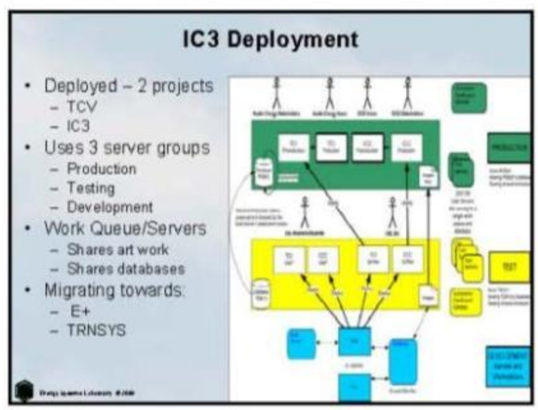
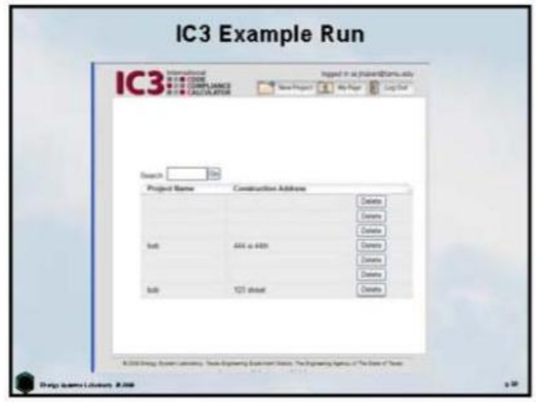
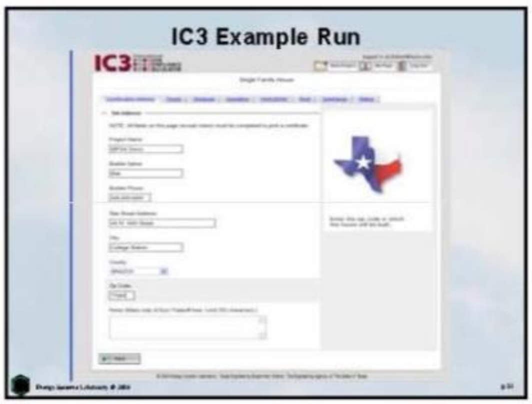


Figure 10-10: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 3)





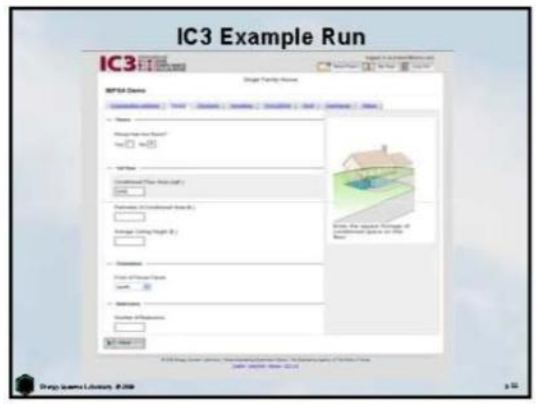


Figure 10-11: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 4)

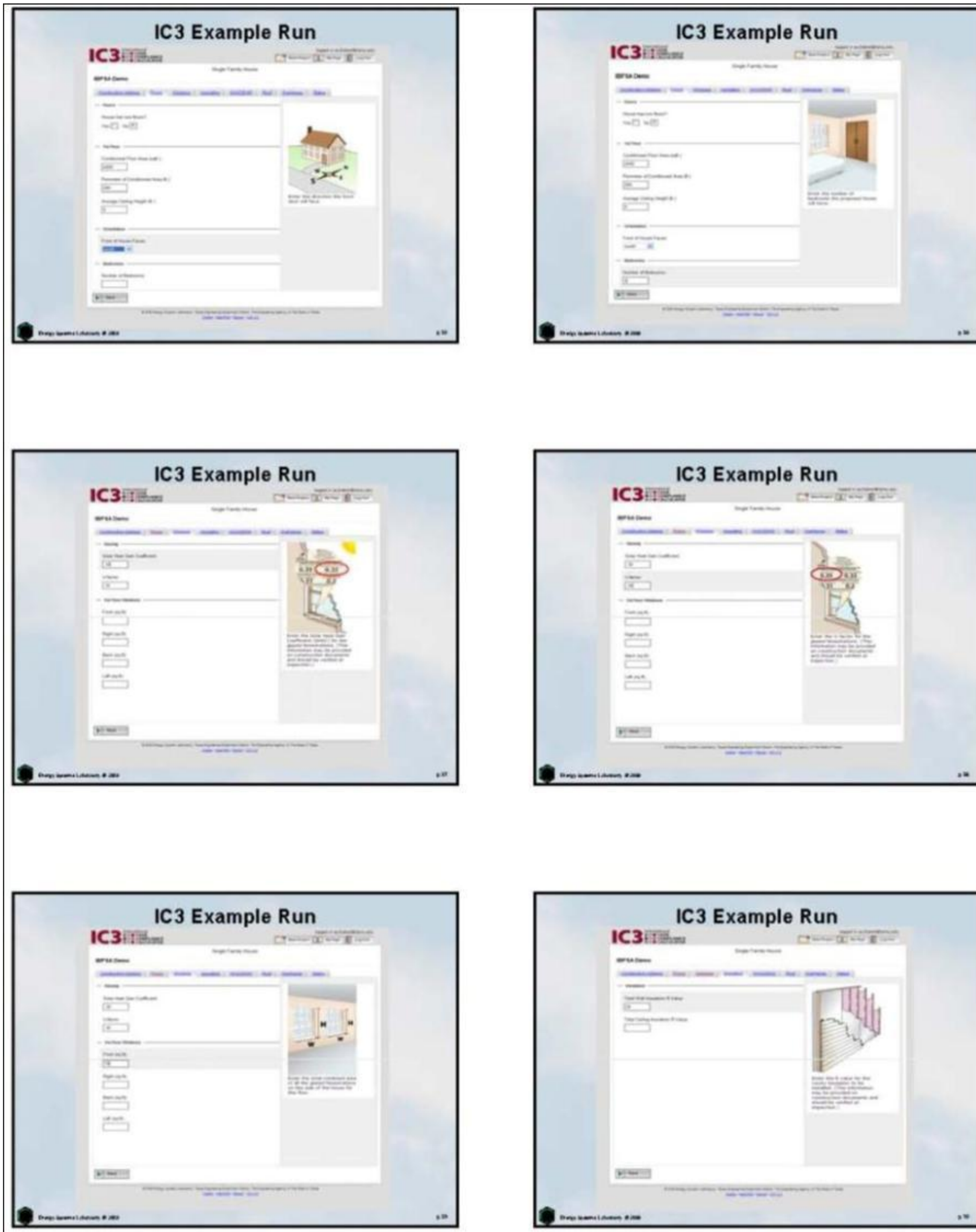


Figure 10-12: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 5)

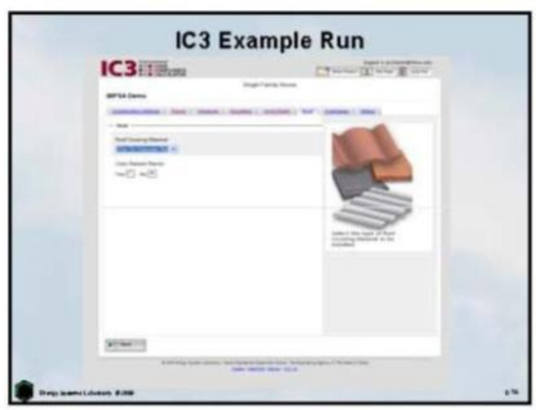


Figure 10-13: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 6)

Figure 10-14: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 7)

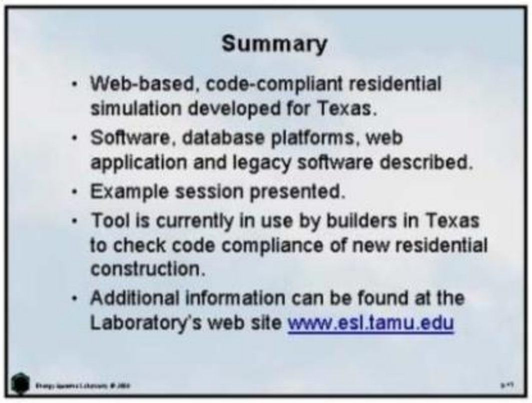
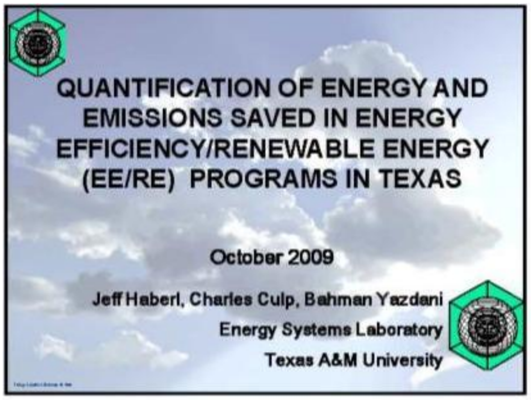
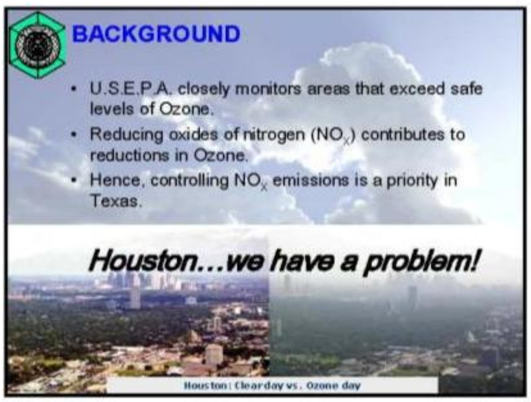


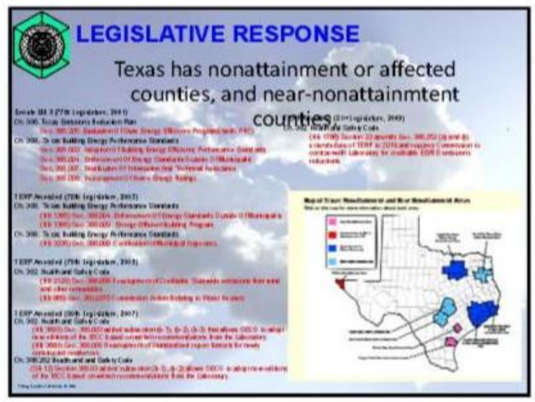
Figure 10-15: Presentation to IBPSA, Glasgow, Scotland (July 2009) (Part 8)

10.4 Presentation to IBPSA, Glasgow, Scotland (July 2009)

In October of 2009, the Energy Systems Lab made a presentation at the CATEE conference about the quantification of energy and emissions saved in Energy Efficiency/Renewable Energy (EE/RE) programs in Texas Houston, Texas.







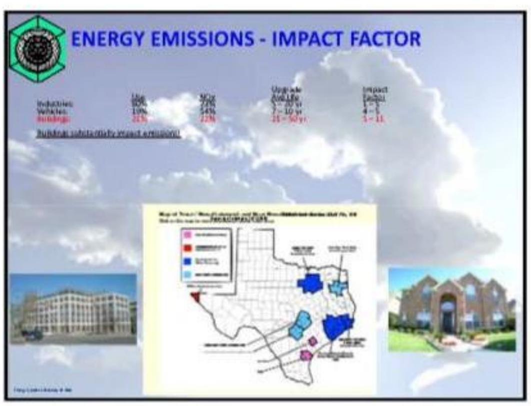
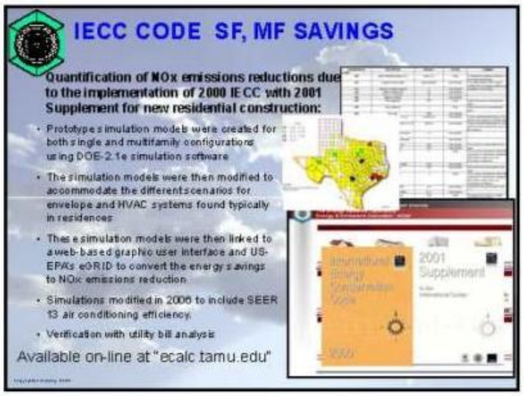
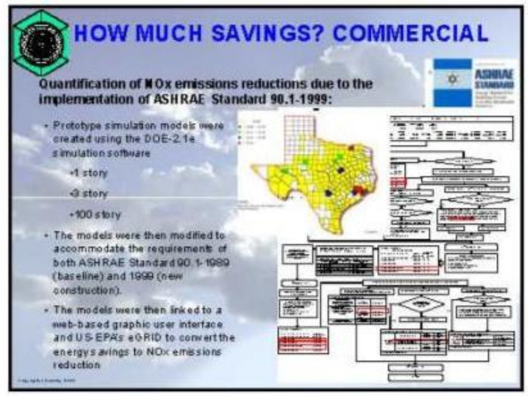
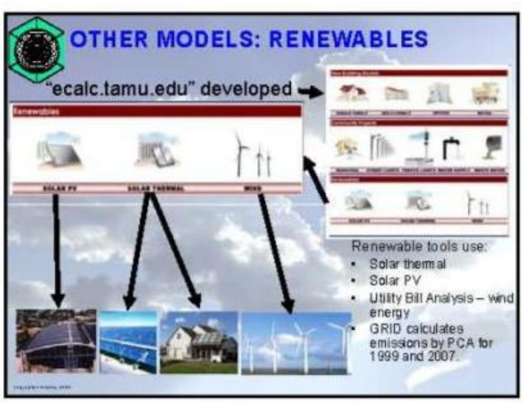


Figure 10-16: Presentation at CATEE Conference, Houston (October 2009) (Part 1)







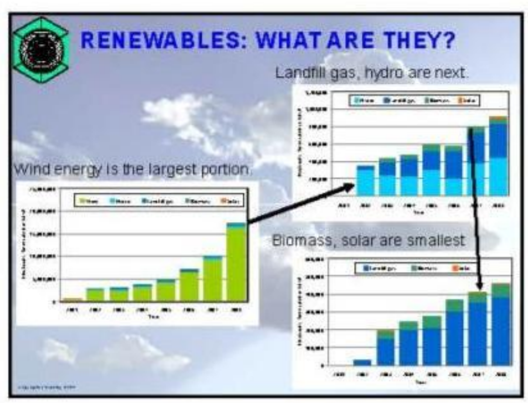
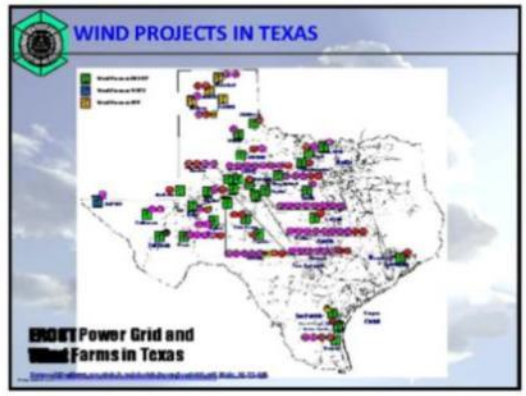
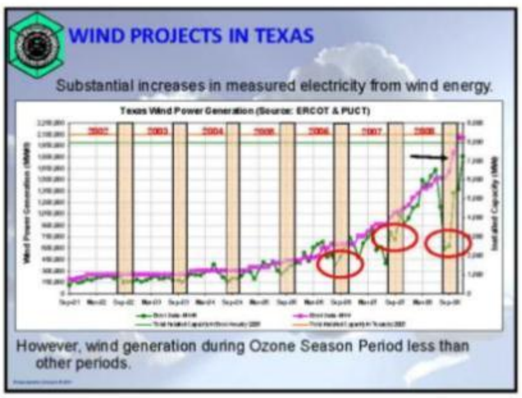
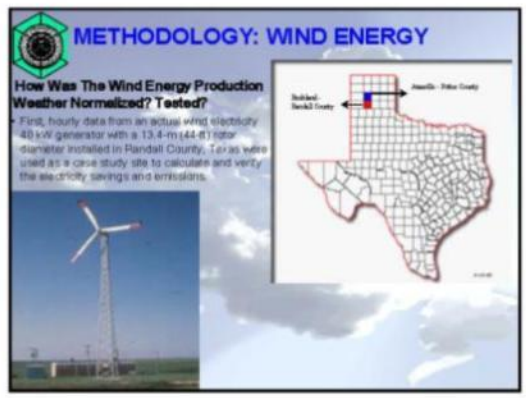
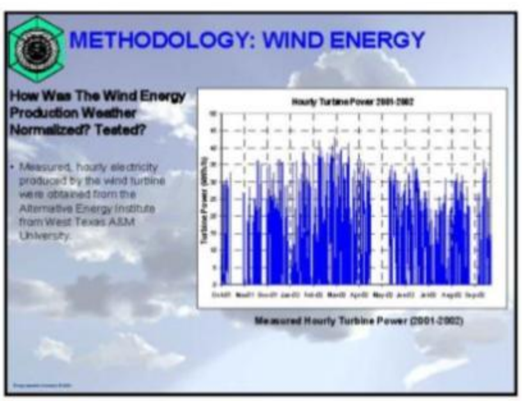


Figure 10-17: Presentation at CATEE Conference, Houston (October 2009) (Part 2)









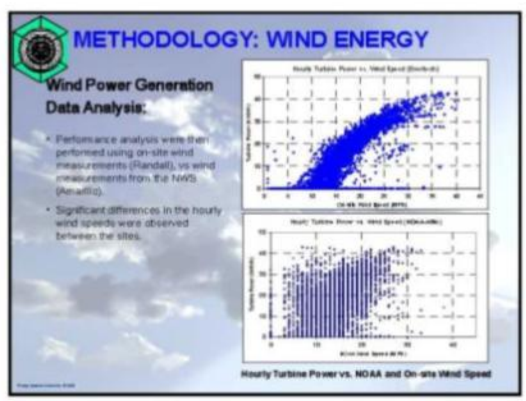
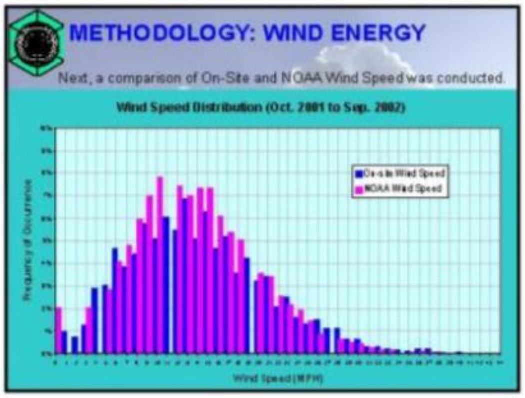
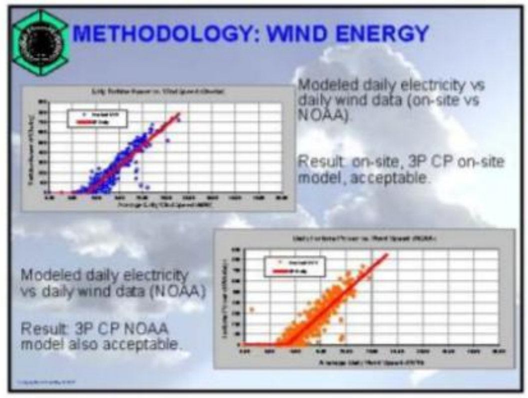
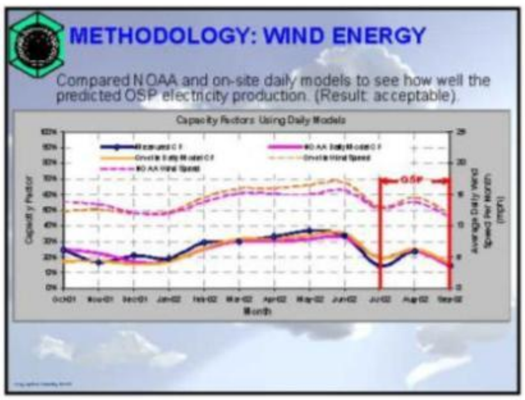
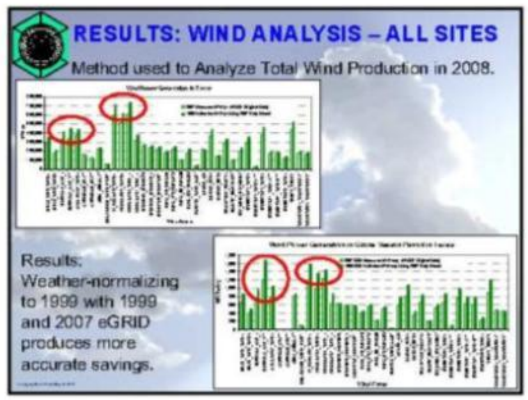


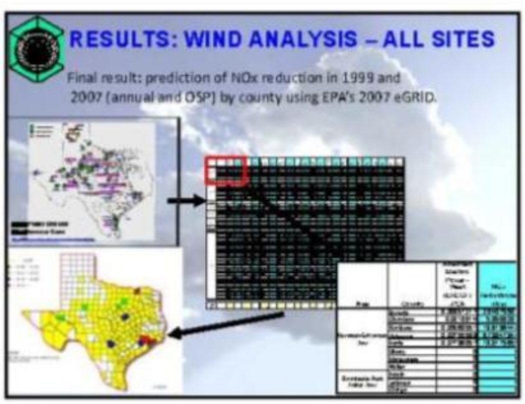
Figure 10-18: Presentation at CATEE Conference, Houston (October 2009) (Part 3)











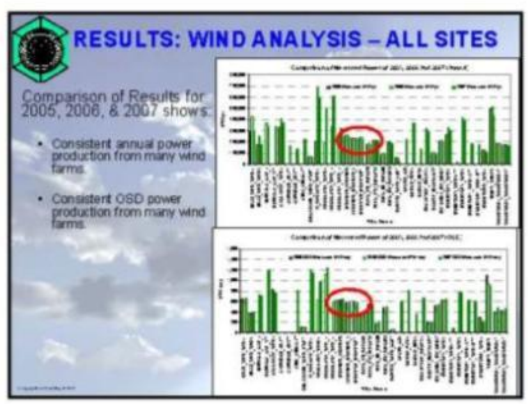
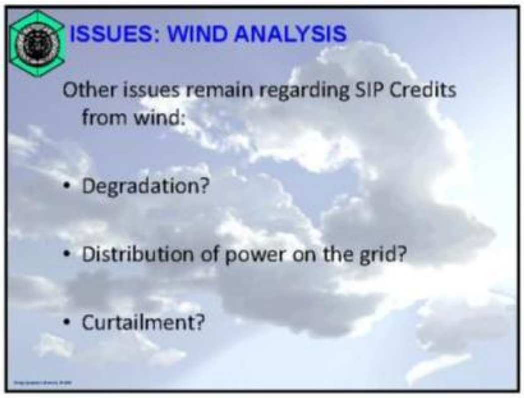
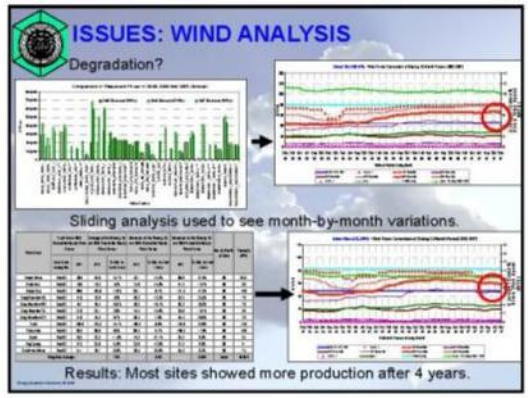
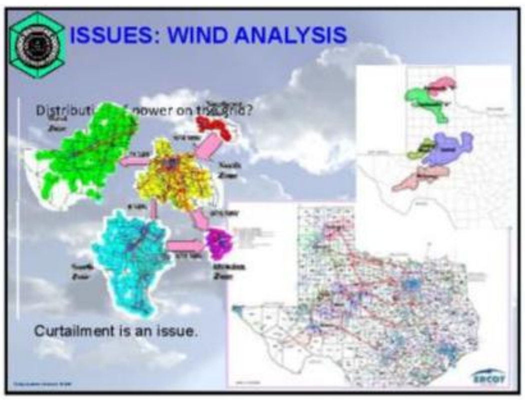
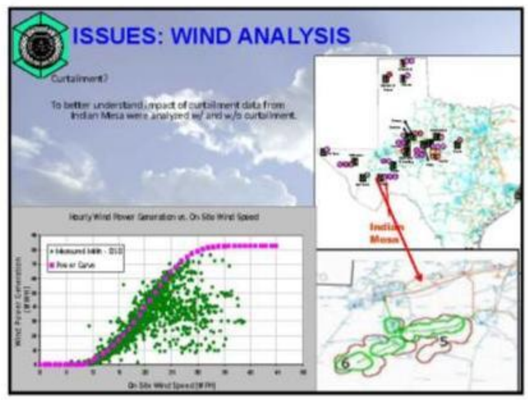


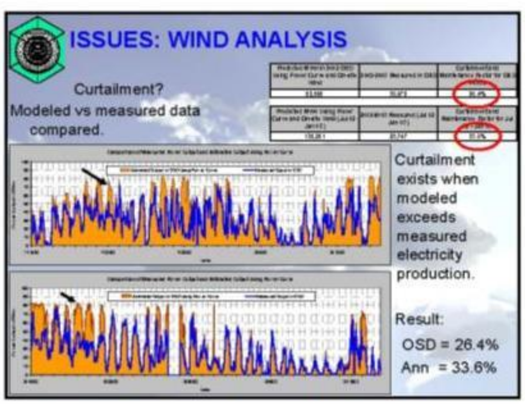
Figure 10-19: Presentation at CATEE Conference, Houston (October 2009) (Part 4)











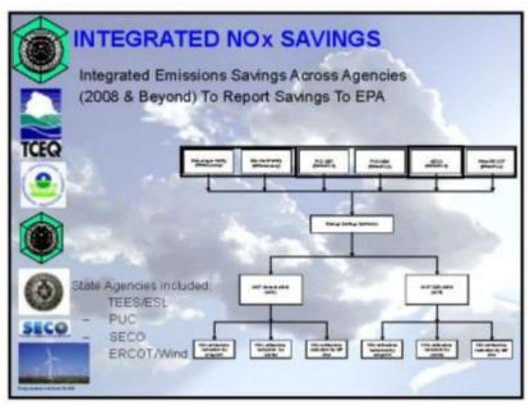
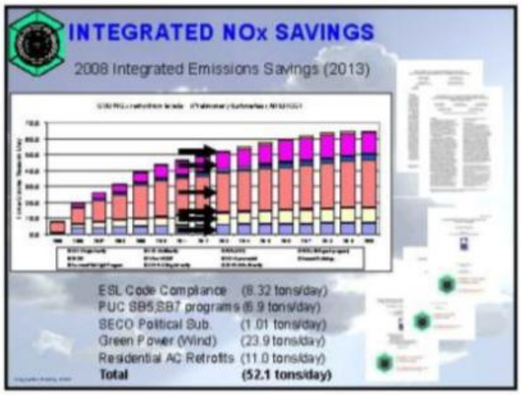


Figure 10-20: Presentation at CATEE Conference, Houston (October 2009) (Part 5)



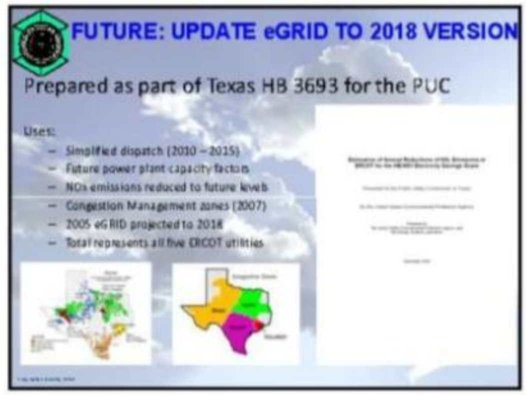


Figure 10-21: Presentation at CATEE Conference, Houston (October 2009) (Part 6)

11 APPENDIX B

In this section, the linear regression models developed, based on 2008 wind power generation data, are presented for each wind farm. The estimated 1999 annual and OSP power production using 2008 daily models and the resulting emissions reduction are also shown in details for each wind farm. A listing of the wind farms analyzed in this year's report is illustrated in Table 11-1.

Table 11-1: Listing of Wind Farms Analyzed for Base-year Calculations

No.	Wind Farms
1	Brazos Wind Ranch
2	Buffalo Gap 1
3	Buffalo Gap 2
4	Buffalo Gap 3
5	Callahan Divide Wind Energy Center
6	Capricorn Ridge Wind Expansion
7	Capricorn Ridge Wind
8	Camp Springs Wind Energy Center
9	Camp Springs Energy Expansion
10	Delaware Mountain Wind Farm
11	Snyder Wind Project
12	Silver Star Phase 1
13	Goat Wind and Goat Wind Phase 2
14	Horse Hollow Phase 1
15	Horse Hollow Phase 2
16	Horse Hollow Phase 3
17	Horse Hollow Phase 4
18	Desert Sky
19	Indian Mesa
20	King Mountain Wind Ranch
21	Texas Wind Power Project
22	Lone Star - Post Oak Wind
23	Lone Star - Mesquite Wind
24	Forest Creek Wind Farm
25	Sand Bluff Wind Farm
26	Red Canyon 1
27	Big Spring Wind Power
28	Stanton Wind Energy
29	Southwest Mesa Wind Project
30	Sweetwater Wind 1
31	Sweetwater Wind 2
32	Sweetwater Wind 3
33	Sweetwater Wind 4
34	Sweetwater Wind 5
35	Roscoe Wind Farm 1
36	Champion Wind Farm
37	Trent Mesa
38	Whirlwind
39	Woodward Mountain Ranch

11.1 Brazos Wind Ranch

Table 11-2: Site Information for Brazos Wind Ranch

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
BRAZ_WIND	WIND	Fluvana	SCURRY	Dec-03	99	Cielo/Orion/Green Mountain	Brazos Wind Ranch	Mitsubishi 1000 (160)	ERCOT	AEP-West	ONCOR	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BRAZ_WND_WND1	BRAZ_WIND	99
BRAZ_WND_WND2	BRAZ_WIND	61

11.1.1 Brazos Wind Ranch – BRAZ_WND_WND1

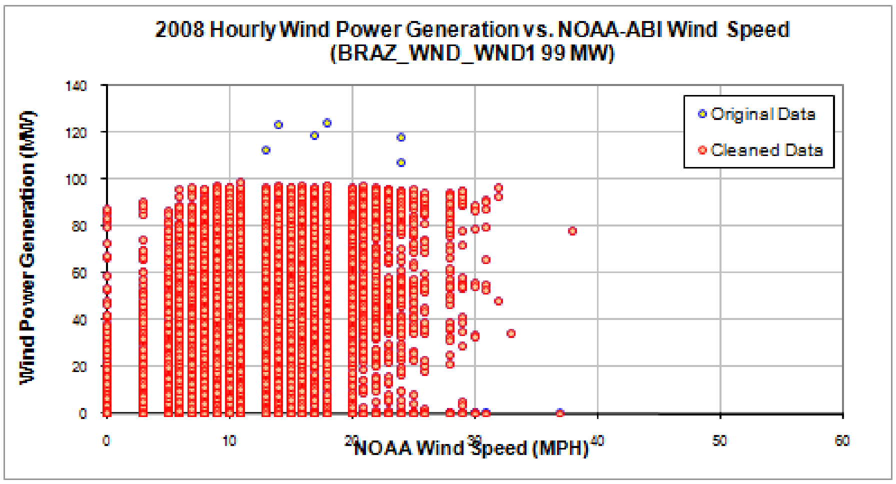


Figure 11-1: BRAZ_WND_WND1 - Hourly Wind Power vs. NOAA Wind Speed (2008)

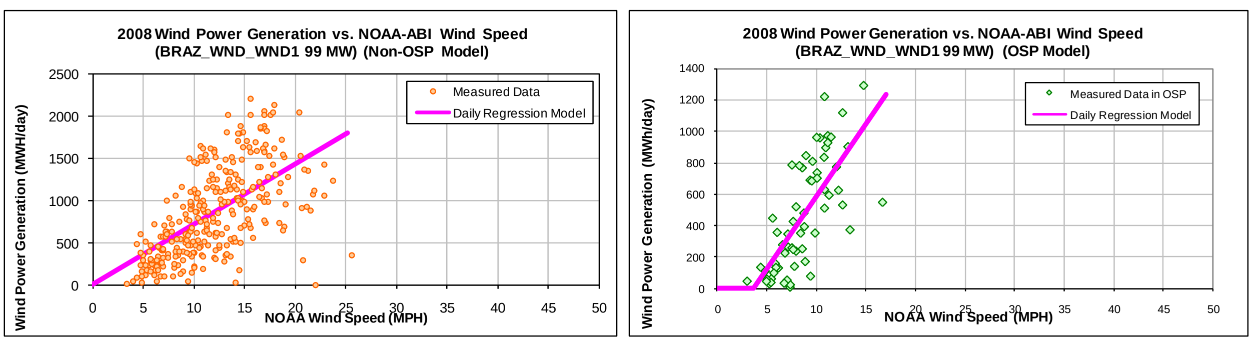


Figure 11-2: BRAZ_WND_WND1 - Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non OSP Model)

Table 11-3: BRAZ_WND_WND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-3.2008
Left Slope (MWh/mph-day)	71.8247
RMSE (MWh/day)	422.4038
R2	0.3597
CV-RMSE	49.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-338.2232
Left Slope (MWh/mph-day)	92.2873
RMSE (MWh/day)	242.3098
R2	0.5259
CV-RMSE	52.0%

Table 11-4: BRAZ_WND_WND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	32,449	26,522	18.27%	46%	37%
Feb-08	28	12.53	30,031	25,118	16.36%	45%	38%
Mar-08	31	13.35	34,424	29,618	13.96%	47%	40%
Apr-08	30	13.87	23,913	29,782	-24.55%	34%	42%
May-08	31	12.79	19,067	28,373	-48.81%	26%	39%
Jun-08	30	13.70	21,105	29,421	-39.40%	30%	41%
Jul-08	31	10.58	23,343	21,465	8.04%	32%	29%
Aug-08	31	7.43	10,784	10,838	-0.50%	15%	15%
Sep-08	30	7.95	12,123	14,809	-22.15%	17%	21%
Oct-08	30	10.23	24,242	21,936	9.51%	34%	31%
Nov-08	30	10.24	25,197	21,966	12.82%	35%	31%
Dec-08	31	12.20	30,197	27,065	10.37%	41%	37%
Total	363	11.43	286,875	286,914	-0.01%	33%	33%
Total in OSP (07/15-09/15)	63	8.71	29,332	29,390	-0.20%	20%	20%

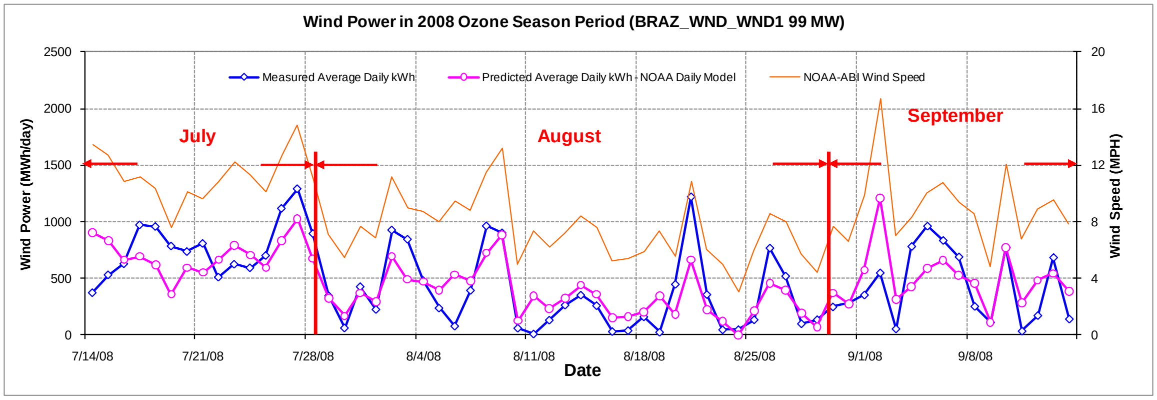


Figure 11-3: BRAZ_WND_WND1 - Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

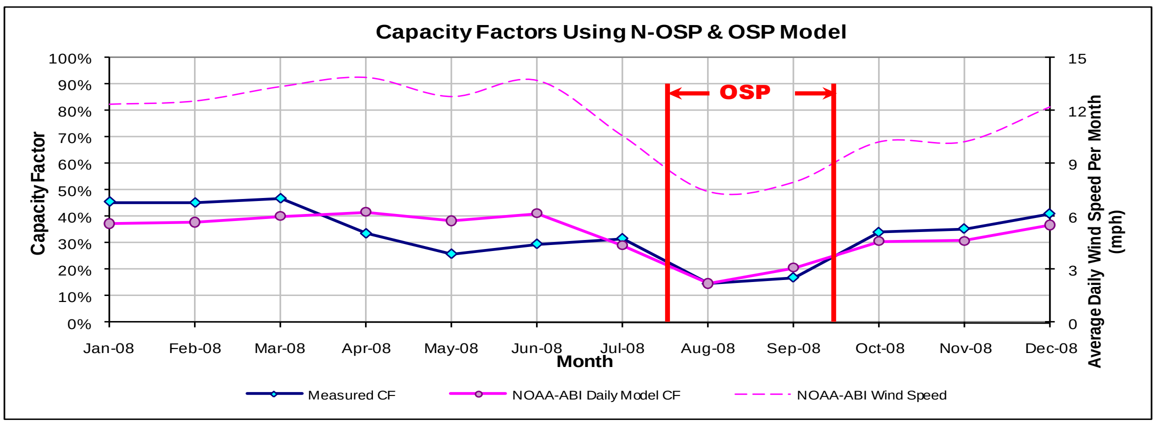


Figure 11-4: BRAZ_WND_WND1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-5: BRAZ_WND_WND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
286,275	289,246	289,285

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
558	466	467

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.1.2 Brazos Wind Ranch – BRAZ_WND_WND2

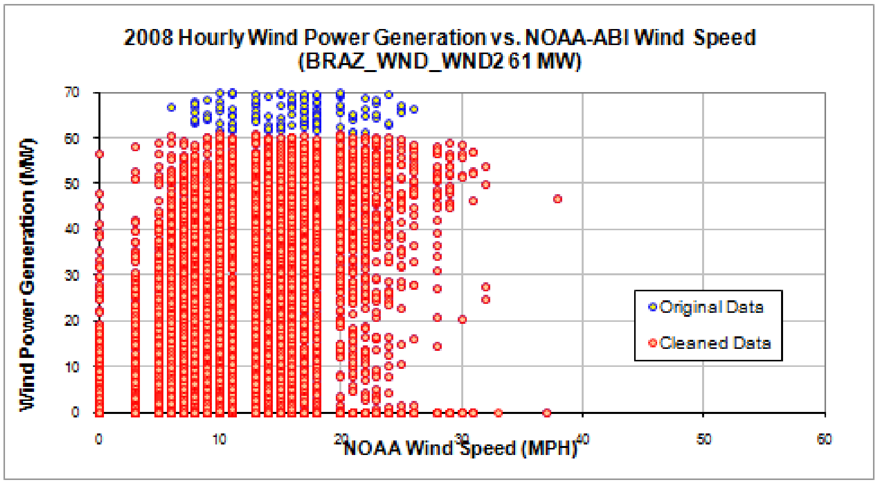


Figure 11-5: BRAZ_WND_WND2 - Hourly Wind Power vs. NOAA Wind Speed (2008)

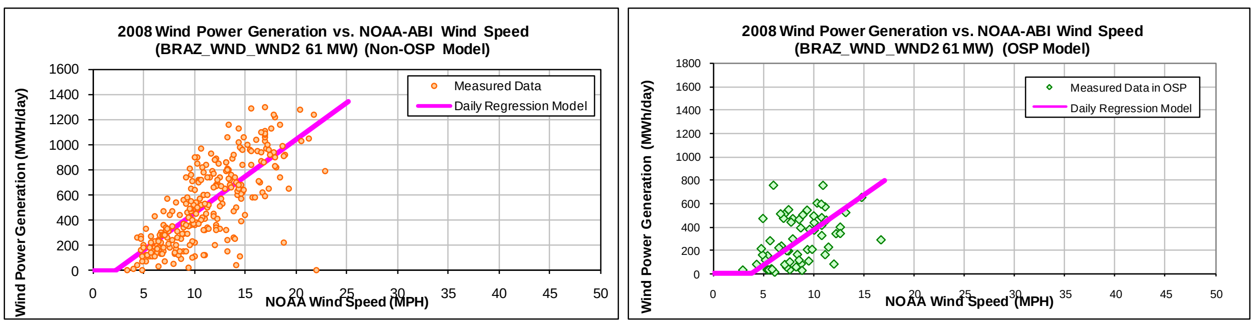


Figure 11-6: BRAZ_WND_WND2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-6: BRAZ_WND_WND2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-132.1732
Left Slope (MWh/mph-day)	58.3166
RMSE (MWh/day)	218.0052
R2	0.5424
CV-RMSE	41.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-230.9726
Left Slope (MWh/mph-day)	60.1566
RMSE (MWh/day)	125.6024
R2	0.6369
CV-RMSE	42.9%

Table 11-7: BRAZ_WND_WND2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	19,319	17,276	10.57%	44%	39%
Feb-08	29	12.36	17,806	17,073	4.12%	42%	40%
Mar-08	29	13.34	18,876	18,723	0.81%	44%	44%
Apr-08	21	12.30	10,379	12,293	-18.44%	34%	40%
May-08	18	10.43	9,024	8,567	5.06%	34%	33%
Jun-08	21	11.21	9,694	10,951	-12.97%	32%	36%
Jul-08	31	10.58	14,350	13,679	4.67%	32%	30%
Aug-08	31	7.43	6,518	6,750	-3.56%	14%	15%
Sep-08	30	7.95	7,682	8,709	-13.37%	17%	20%
Oct-08	31	10.48	15,719	14,841	5.59%	35%	33%
Nov-08	30	10.24	14,478	13,947	3.66%	33%	32%
Dec-08	31	12.20	16,888	17,958	-6.34%	37%	40%
Total	332	10.84	160,733	160,768	-0.02%	33%	33%
Total in OSP (07/15-09/15)	63	8.71	18,458	18,506	-0.26%	20%	20%

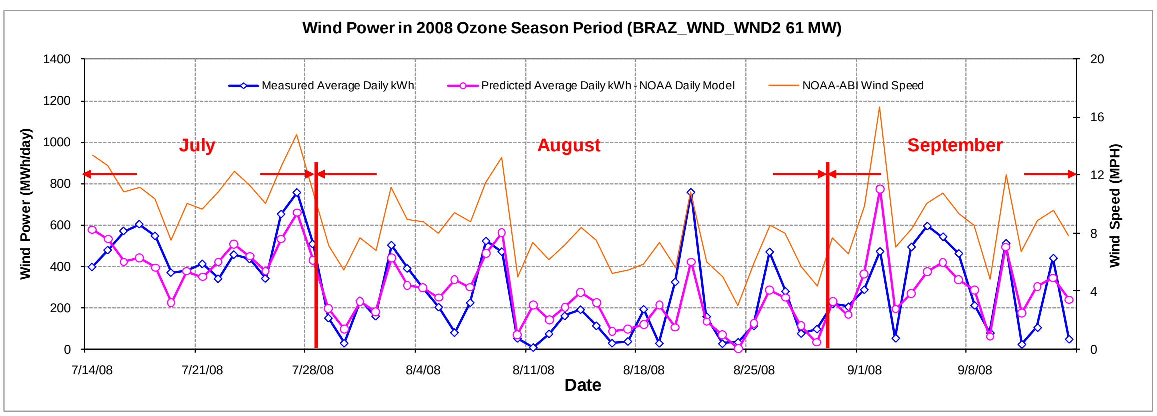


Figure 11-7: BRAZ_WND_WND2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

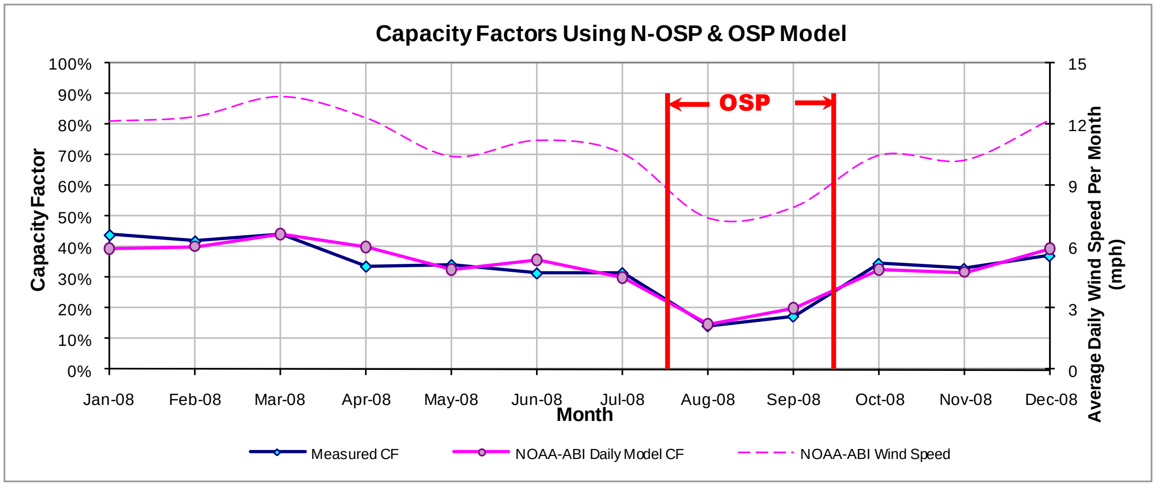


Figure 11-8: BRAZ_WND_WND2 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-8: BRAZ_WND_WND2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
187,016	177,194	177,232

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
353	293	294

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.2 Buffalo Gap 1(BUFF_GAP_UNIT1)

Table 11-9: Site Information for Buffalo Gap 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
BUFF_CAP	WIND	Abilene	TAYLOR	Sep-05	120	AES Corporation	Buffalo Gap1	Vestas 1.8 MW (67)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BUFF_GAP_UNIT1	BUFF_CAP	120

11.2.1 Buffalo Gap 1 – BUFF_GAP_UNIT1 120 MW)

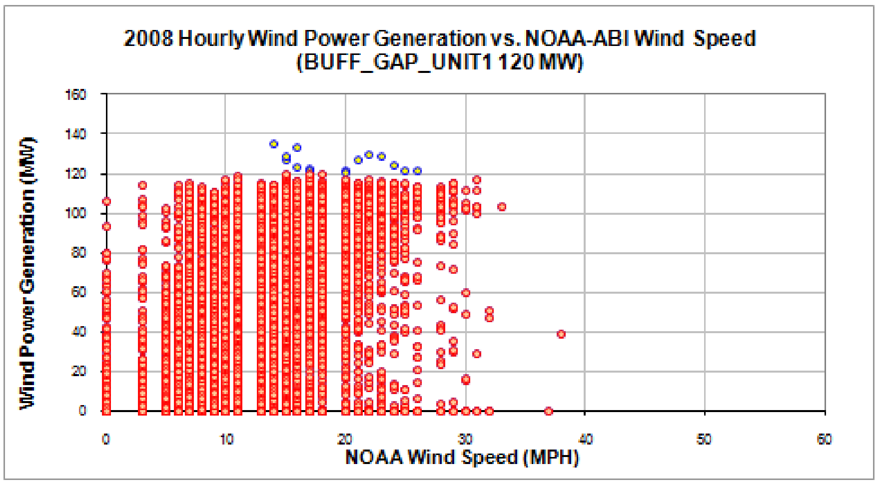
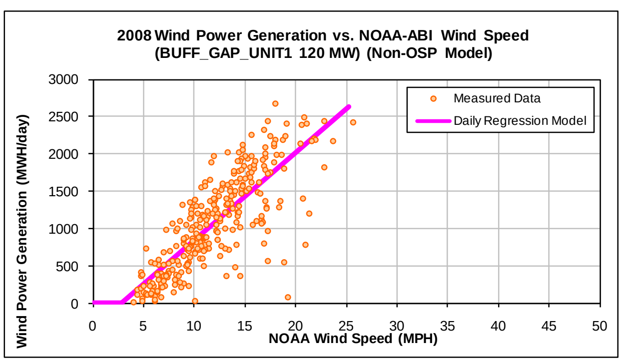


Figure 11-9: BUFF_GAP_UNIT1 – Hourly Wind Power vs. NOAA Wind Speed (2008)



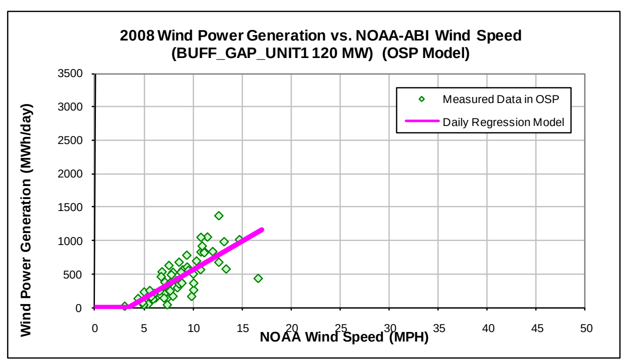


Figure 11-10: BUFF_GAP_UNIT1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-10: BUFF_GAP_UNIT1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-331.9403
Left Slope (MWh/mph-day)	117.8749
RMSE (MWh/day)	379.0919
R2	0.6476
CV-RMSE	35.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-297.9633
Left Slope (MWh/mph-day)	85.6662
RMSE (MWh/day)	207.1245
R2	0.5693
CV-RMSE	47.6%

Table 11-11: BUFF_GAP_UNIT1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	34,322	32,977	3.92%	40%	38%
Feb-08	29	12.36	32,060	32,631	-1.78%	38%	39%
Mar-08	31	13.35	43,441	38,480	11.42%	49%	43%
Apr-08	30	13.87	31,188	39,076	-25.30%	36%	45%
May-08	31	12.79	37,605	36,437	3.10%	42%	41%
Jun-08	29	13.52	36,661	36,581	0.22%	44%	44%
Jul-08	27	10.52	20,240	20,528	-1.42%	26%	26%
Aug-08	31	7.43	10,793	10,541	2.34%	12%	12%
Sep-08	30	7.95	11,611	14,239	-22.63%	13%	16%
Oct-08	28	10.30	26,744	24,703	7.63%	33%	31%
Nov-08	30	10.24	29,655	26,248	11.49%	34%	30%
Dec-08	30	11.87	30,140	32,025	-6.25%	35%	37%
Total	356	11.36	344,459	344,466	0.00%	34%	34%
Total in OSP (07/15-09/15)	59	8.55	25,658	25,695	-0.15%	15%	15%

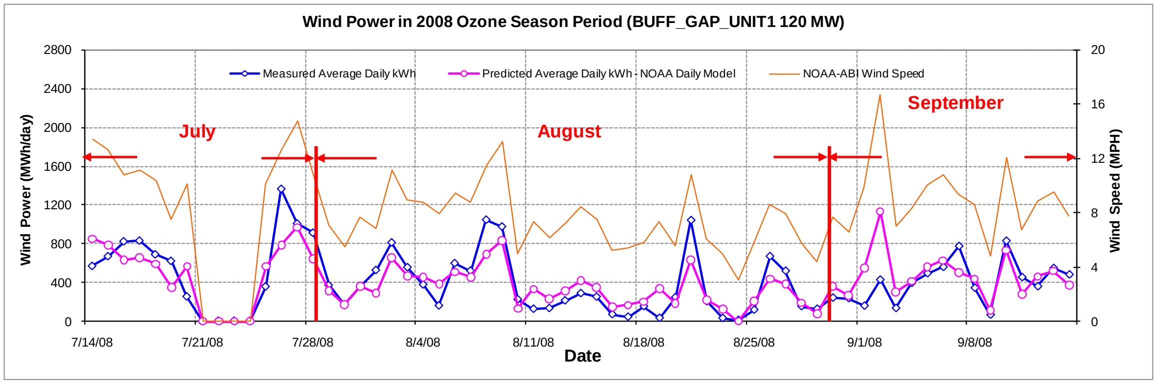


Figure 11-11: BUFF_GAP_UNIT1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

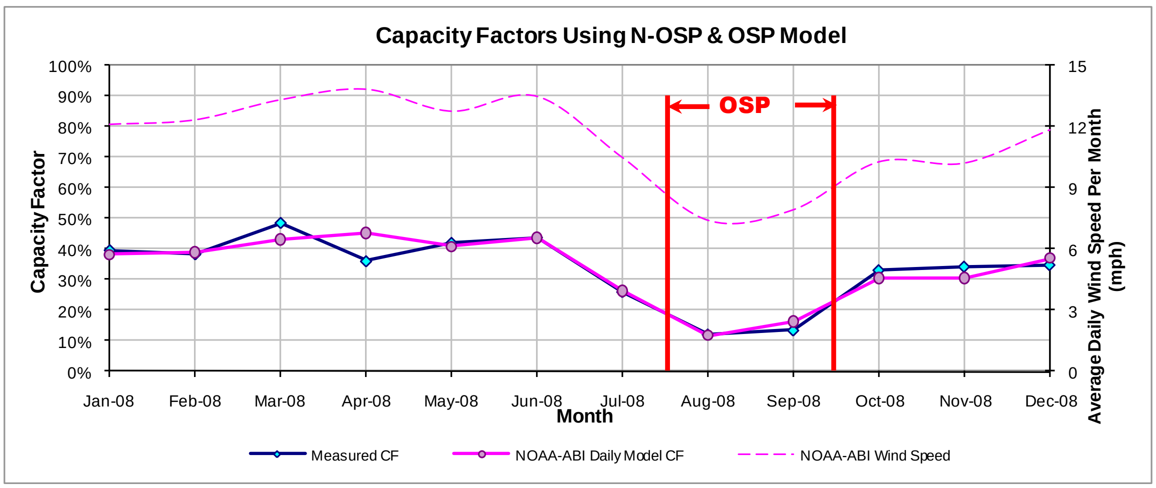


Figure 11-12: BUFF_GAP_UNIT1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-12: BUFF_GAP_UNIT1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2007 Daily Model)
347,148	354,135	354,142

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
534	435	436

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.3 Buffalo Gap 2(BUFF_GAP_UNIT2)

Table 11-13: Site Information for Buffalo Gap 2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
BUFF_GAP 2	WIND	Abilene	TAYLOR	May-07	233	AES Corporation	Buffalo Gap2	Vestas 1.8 MW (67)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BUFF_GAP_UNIT2	BUFF_CAP	233

11.3.1 Buffalo Gap 2-BUFF_GAP_UNIT2

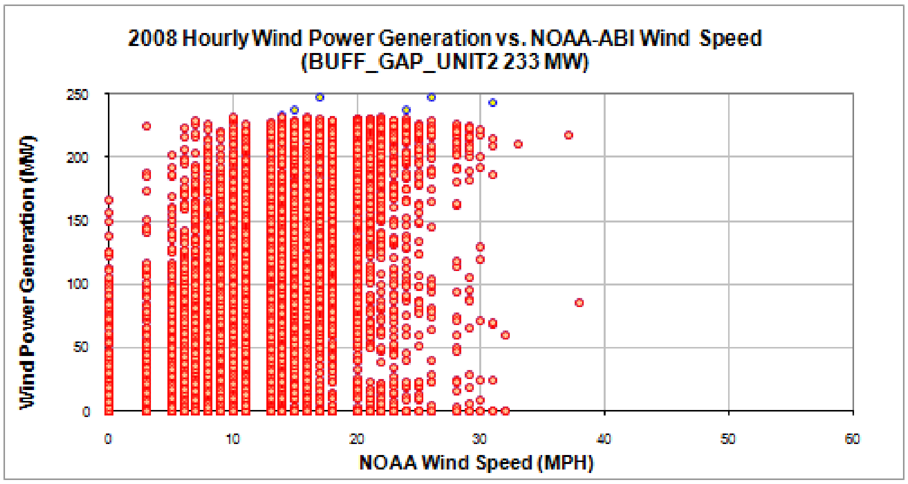


Figure 11-13: BUFF_GAP 2_UNIT2 – Hourly Wind Power vs. NOAA Wind Speed (2008)

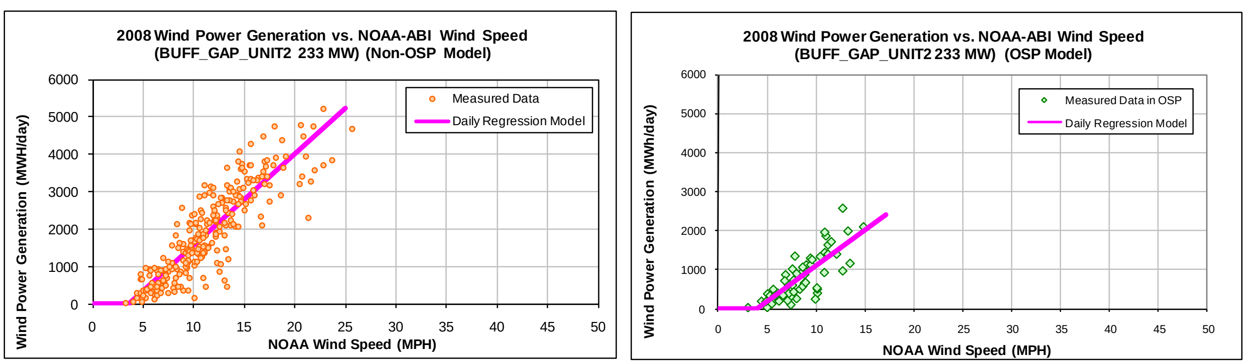


Figure 11-14: BUFF_GAP 2_UNIT2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-14: BUFF_GAP 2_UNIT2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-887.4995
Left Slope (MWh/mph-day)	244.6885
RMSE (MWh/day)	577.6468
R2	0.7654
CV-RMSE	30.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-737.8941
Left Slope (MWh/mph-day)	184.0841
RMSE (MWh/day)	359.5979
R2	0.6357
CV-RMSE	44.3%

Table 11-15: BUFF_GAP 2_UNIT2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	11.96	61,511	59,159	3.82%	38%	36%
Feb-08	28	12.30	62,799	59,413	5.39%	40%	38%
Mar-08	31	13.35	86,070	73,726	14.34%	50%	43%
Apr-08	25	13.22	52,454	58,690	-11.89%	38%	42%
May-08	27	12.26	54,591	57,029	-4.47%	36%	38%
Jun-08	27	13.34	61,695	64,146	-3.97%	41%	42%
Jul-08	26	10.38	33,527	36,602	-9.17%	23%	25%
Aug-08	31	7.43	21,037	19,722	6.25%	12%	11%
Sep-08	29	7.65	18,953	23,310	-22.99%	12%	14%
Oct-08	26	9.20	35,706	35,508	0.55%	25%	24%
Nov-08	26	9.27	34,481	35,893	-4.09%	24%	25%
Dec-08	19	9.13	25,761	25,581	0.70%	24%	24%
Total	324	10.81	548,585	548,777	-0.04%	30%	30%
Total in OSP (07/15-09/15)	58	8.41	47,037	47,216	-0.38%	15%	15%

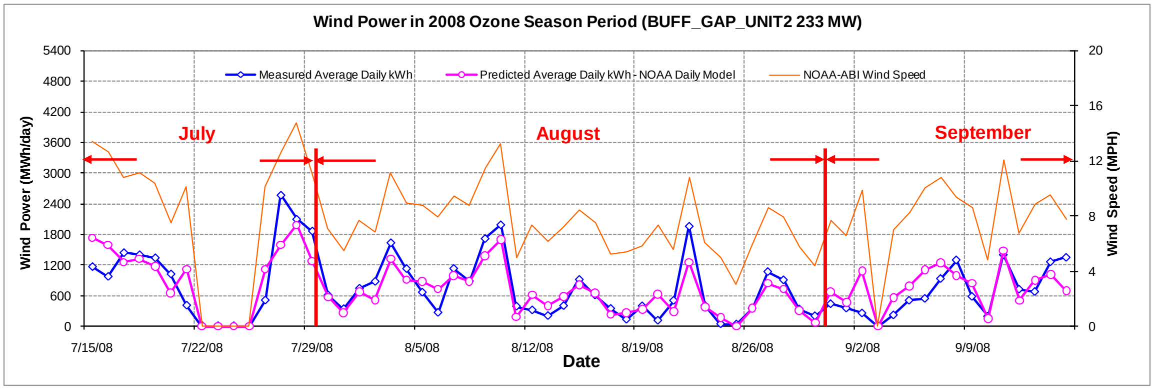


Figure 11-15: BUFF_GAP 2_UNIT2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

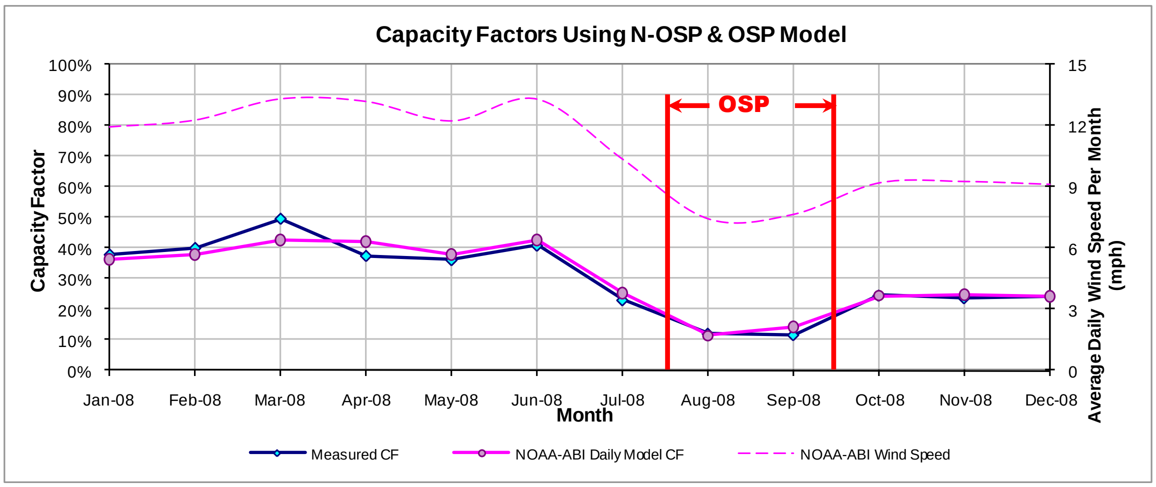


Figure 11-16: BUFF_GAP 2_UNIT2 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-16: BUFF_GAP 2_UNIT2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
657,194	619,698	619,915

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
1,049	811	814

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.4 Buffalo Gap 3(BUFF_GAP_UNIT3)

Table 11-17: Site Information for Buffalo Gap 3

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
BUFF_GAP 3	WIND	Abilene	Taylor	Apr-08	170	AES Corporation	Buffalo Gap3		ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
BUFF_GAP_UNIT3	BUFF_GAP	170

11.4.1 Buffalo Gap 3-BUFF_GAP_UNIT3

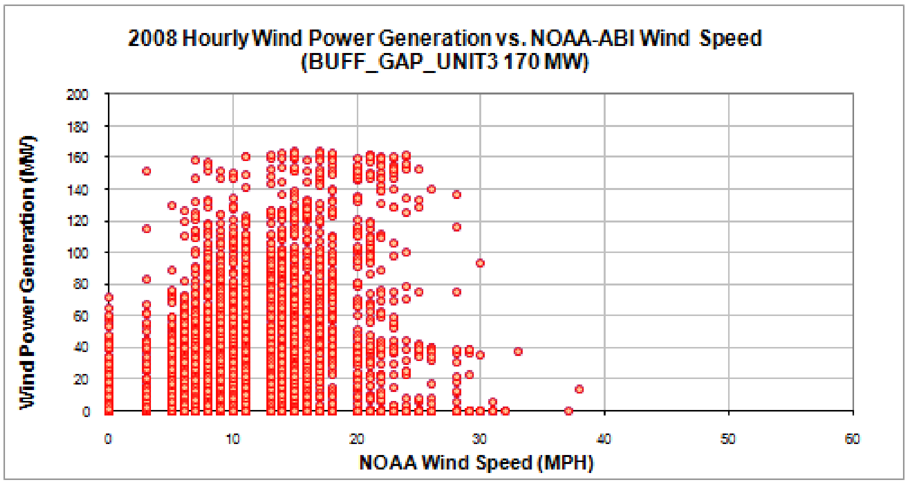

Figure 11-17: BUFF_GAP 3_UNIT3 – Hourly Wind Power vs. NOAA Wind Speed (2008)

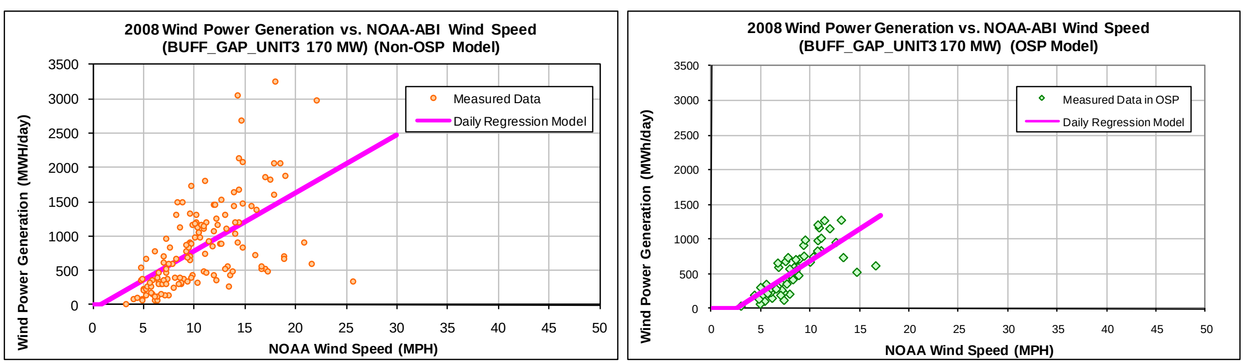

Figure 11-18: BUFF_GAP 3_UNIT3 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-18: BUFF_GAP 3_UNIT3 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-59.0294
Left Slope (MWh/mph-day)	84.6563
RMSE (MWh/day)	522.4347
R2	0.3333
CV-RMSE	62.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-231.4471
Left Slope (MWh/mph-day)	92.0445
RMSE (MWh/day)	226.8515
R2	0.5637
CV-RMSE	41.9%

Table 11-19: BUFF_GAP 3_UNIT3 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-00	23	12.80	11,258	23,567	-109.33%	12%	25%
Mar-00	24	10.46	17,399	18,886	-8.54%	18%	19%
Apr-00	31	7.43	14,047	14,031	0.11%	11%	11%
May-00	29	7.88	14,324	16,162	-12.84%	12%	14%
Jun-00	29	10.06	31,403	22,987	26.80%	27%	19%
Jul-00	29	10.13	26,260	23,166	11.78%	22%	20%
Aug-00	30	11.99	32,808	28,688	12.56%	27%	23%
Total	195	10.00	147,499	147,486	0.01%	19%	19%
Total in OSP (07/15-09/15)	55	8.40	29,796	29,792	0.01%	13%	13%

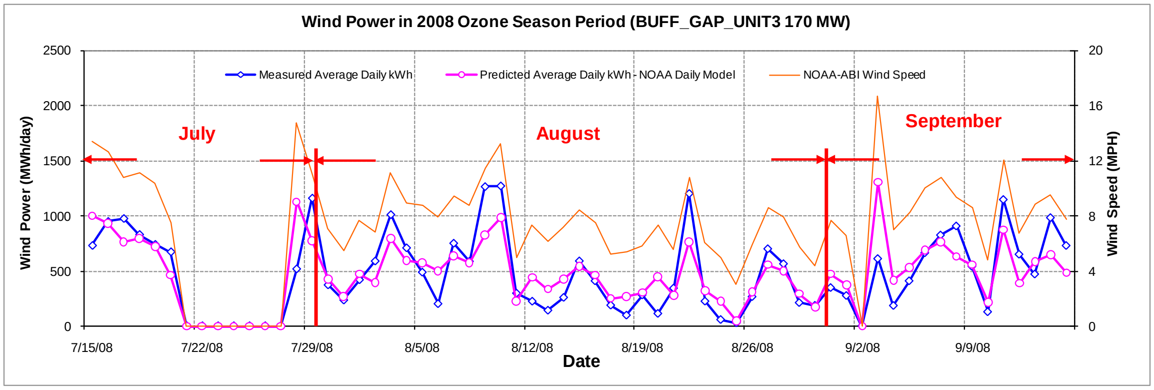

Figure 11-19: BUFF_GAP 3_UNIT3 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

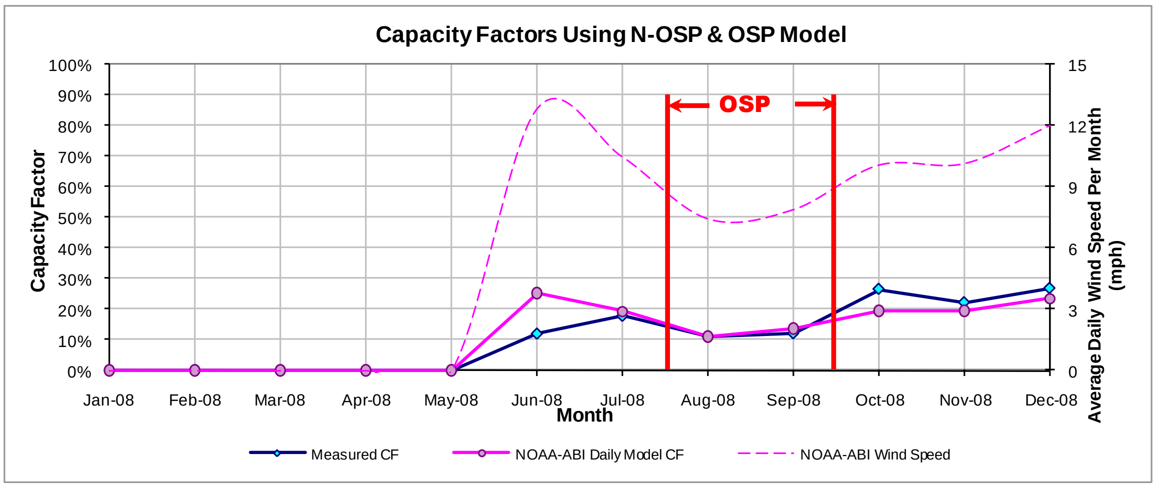

Figure 11-20: BUFF_GAP 3_UNIT3 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-20: BUFF_GAP 3_UNIT3 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
321,031	276,843	276,820

1999 (Jun-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jun-Dec) Measured MWh/yr	2008 (Jun-Dec) Predicted MWh/yr (2008 Daily Model)
163,986	158,845	158,831

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
662	542	542

Note: The 2008 (Jun – Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 210 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.5 Callahan Divide Wind Energy Center

Table 11-21: Site Information for Callahan Divide

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CALLAHAN	WIND	Abilene	TAYLOR	Feb-07	114	FPL Energy	Callahan Divide Wind Energy Center	GE Wind 1500 (76)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CALLAHAN_WND1	CALLAHAN	114

11.5.1 Callahan Divide Wind Energy Center – CALLAHAN_WIND1

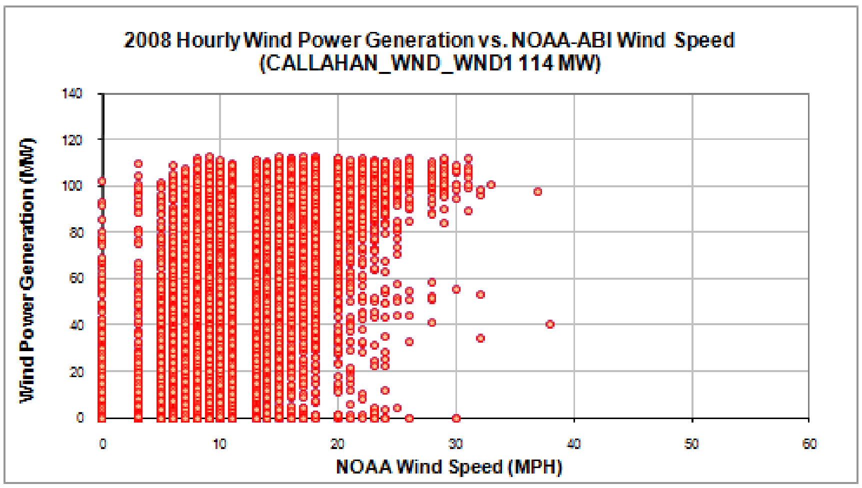

Figure 11-21:CALLAHAN WIND1 – Hourly Wind Power vs. NOAA Wind Speed (2008)

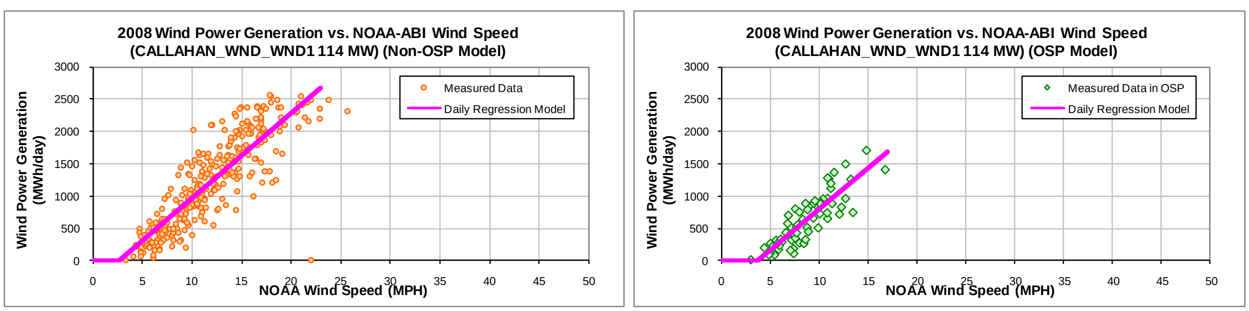

Figure 11-22: CALLAHAN WIND1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-22: CALLAHAN WIND1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-353.7180
Left Slope (MWh/mph-day)	132.0205
RMSE (MWh/day)	356.3509
R2	0.7284
CV-RMSE	28.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-459.1666
Left Slope (MWh/mph-day)	125.3587
RMSE (MWh/day)	208.6756
R2	0.7297
CV-RMSE	33.0%

Table 11-23: CALLAHAN WIND1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	39199.61	37476.60	4.40%	48%	46%
Feb-08	29	12.36	36776.52	37070.39	-0.80%	46%	47%
Mar-08	31	13.35	41705.49	43657.27	-4.68%	49%	51%
Apr-08	30	13.87	43737.25	44307.55	-1.30%	53%	54%
May-08	31	12.79	39983.91	41369.87	-3.47%	47%	49%
Jun-08	30	13.70	42531.72	43643.38	-2.61%	52%	53%
Jul-08	31	10.58	29229.08	29326.94	-0.33%	34%	35%
Aug-08	31	7.43	15287.78	14730.25	3.65%	18%	17%
Sep-08	28	7.90	14002.99	16788.68	-19.89%	18%	22%
Oct-08	31	10.48	31299.98	31908.40	-1.94%	37%	38%
Nov-08	30	10.24	35719.13	29939.80	16.18%	44%	36%
Dec-08	31	12.20	39668.44	38966.00	1.77%	47%	46%
Total	363	11.43	409141.91	409185.13	-0.01%	41%	41%
Total in OSP (07/15-09/15)	63	8.71	39859.36	39937.55	-0.20%	23%	23%

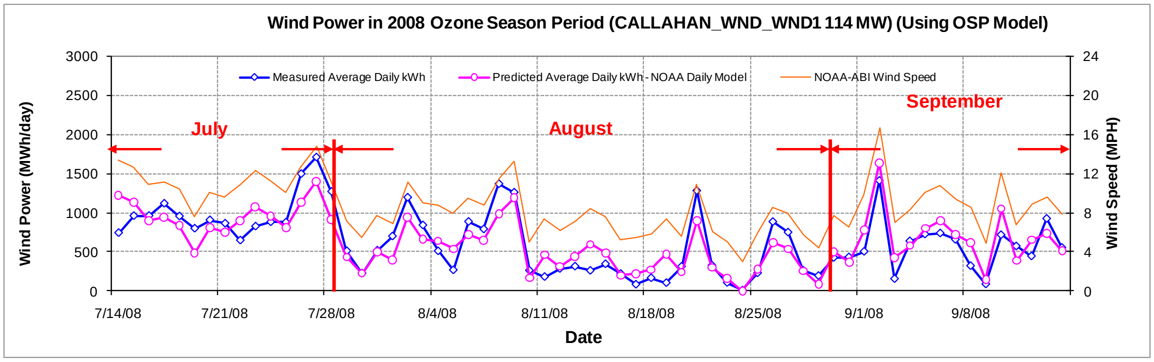

Figure 11-23: CALLAHAN WIND1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

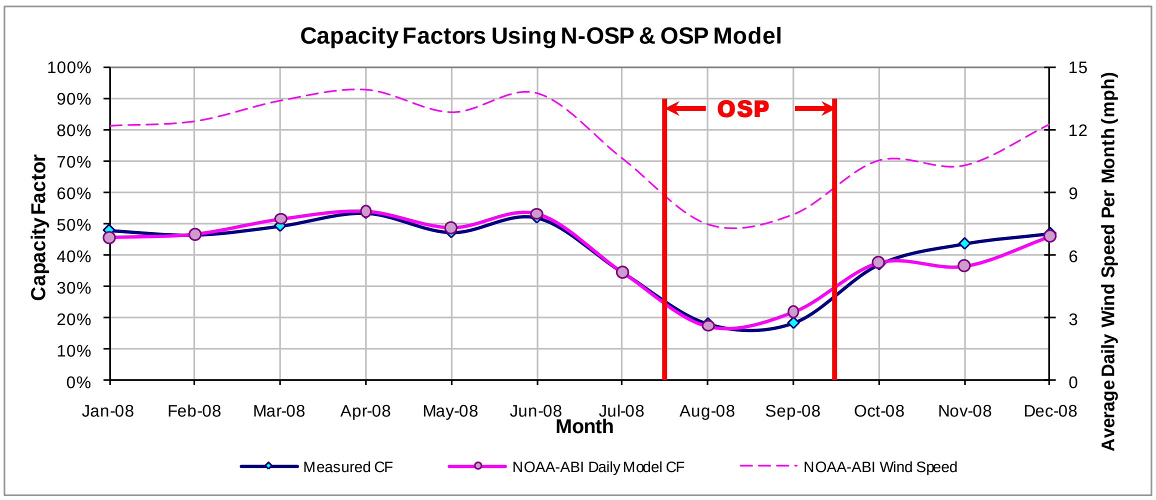

Figure 11-24: CALLAHAN WIND1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-24: CALLAHAN WIND1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
404,330	412,523	412,567

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
758	633	634

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.6 Capricorn Ridge Wind Expansion (CAPRIDGE_CR3)

Table 11-25: Site Information for Capricorn Ridge Wind Expansion

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDGE_CR3	WIND	Abilene	STERLING	May-08	186	FPL Energy	Capricorn Ridge Wind exp.		ERCOT	LCRA	LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDGE_CR3	CAPRIDGE_CR3	186

11.6.1 Capricorn Ridge Wind Expansion – CAPRIDGE_CR3

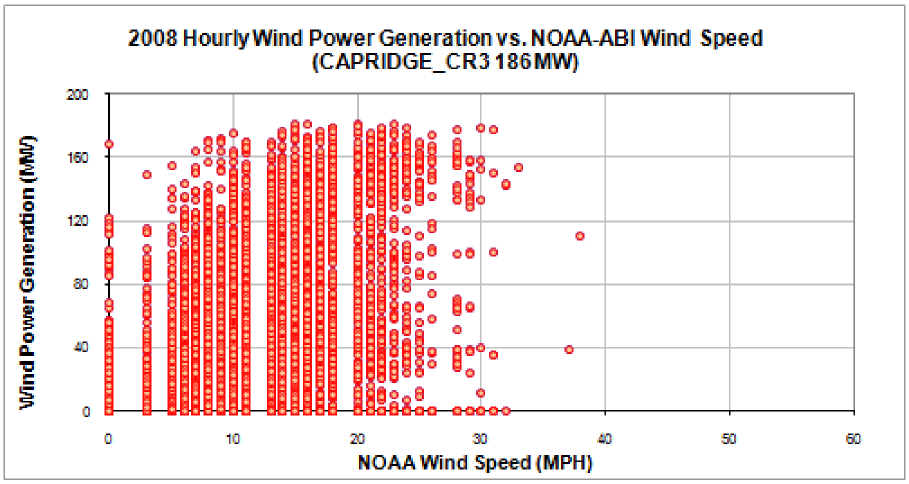

Figure 11-25: CAPRIDGE_CR3– Hourly Wind Power vs. NOAA Wind Speed (2008)

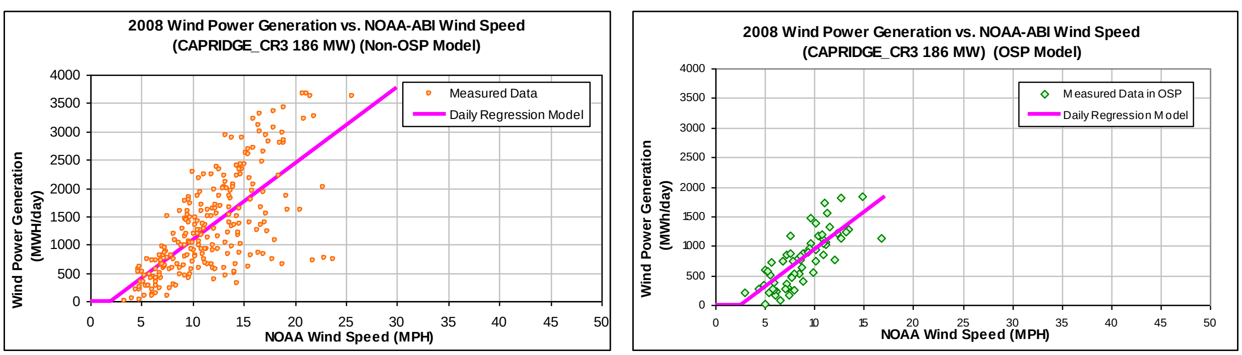

Figure 11-26: CAPRIDGE_CR3– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-26: CAPRIDGE_CR3– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-272.1368
Left Slope (MWh/mph-day)	135.3258
RMSE (MWh/day)	629.9264
R2	0.4746
CV-RMSE	47.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-316.9018
Left Slope (MWh/mph-day)	126.2397
RMSE (MWh/day)	280.5010
R2	0.6077
CV-RMSE	35.8%

Table 11-27: CAPRIDGE_CR3– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08	10	13.11	3,966	15,022	-278.75%	9%	34%
Mar-08	31	13.35	26,120	47,554	-82.06%	19%	34%
Apr-08	28	13.76	43,020	44,513	-3.47%	34%	36%
May-08	31	12.79	52,116	45,209	13.25%	38%	33%
Jun-08	30	13.70	60,561	47,449	21.65%	45%	35%
Jul-08	31	10.58	41,312	33,532	18.83%	30%	24%
Aug-08	31	7.43	17,541	19,260	-9.80%	13%	14%
Sep-08	30	7.95	16,691	22,183	-32.91%	12%	17%
Oct-08	27	9.85	27,652	28,649	-3.61%	23%	24%
Nov-08	28	9.86	31,510	29,729	5.65%	25%	24%
Dec-08	29	11.65	50,461	37,814	25.06%	39%	29%
Total	306	11.16	370,950	370,915	0.01%	27%	27%
Total in OSP (07/15-09/15)	63	8.71	49,305	49,301	0.01%	18%	18%

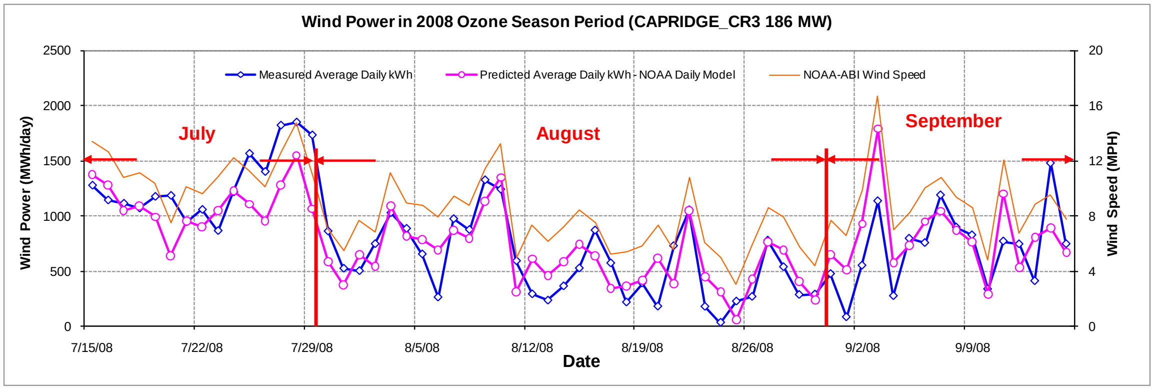

Figure 11-27: CAPRIDGE_CR3– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

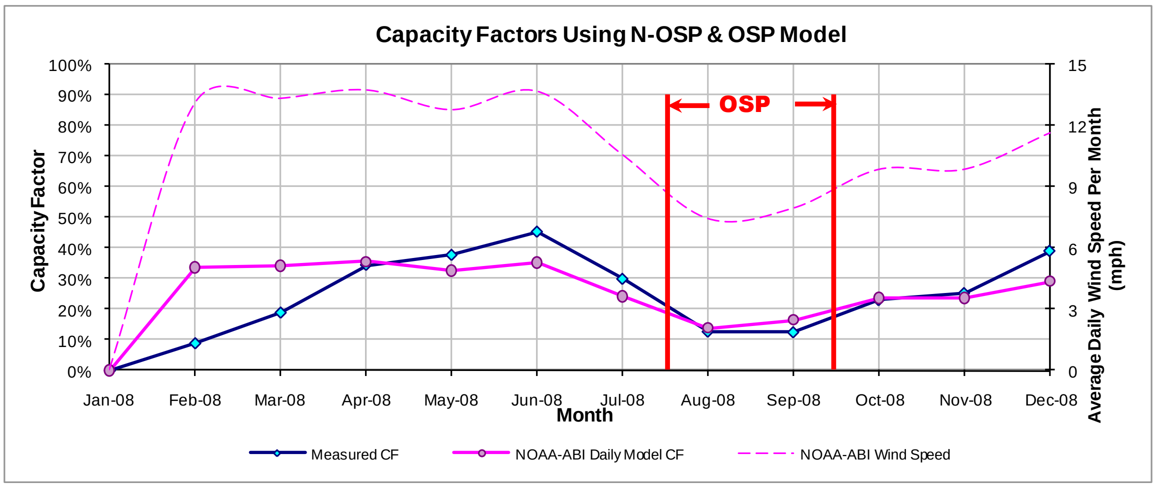

Figure 11-28: CAPRIDGE_CR3– Predicted Capacity Factors Using Daily Models (2008)

Table 11-28: CAPRIDGE_CR3– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
450,051	443,685	443,643

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
909	783	783

1999 (Feb-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Feb-Dec) Measured MWh/yr	2008 (Feb-Dec) Predicted MWh/yr (2008 Daily Model)
388,570	387,921	387,885

Note: The 2008(Feb – Dec) Measured MWh/yr presented in the above table includes only validated data and it was also adjusted to 320 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.7 Capricorn Ridge Wind Expansion (CAPRIDGE4_CR4)

Table 11-29: Site Information for Capricorn Ridge Wind Expansion – CAPRIDGE_CR4

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDG4_CR4	WIND	Abilene	Sterling	May-08	112.5	FPL Energy	Capricorn Ridge Wind exp.		ERCOT	LCRA	LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDG4_CR4	CAPRIDG4_CR4	112.5

11.7.1 Capricorn Ridge Wind Expansion – CAPRIDGE4_CR4

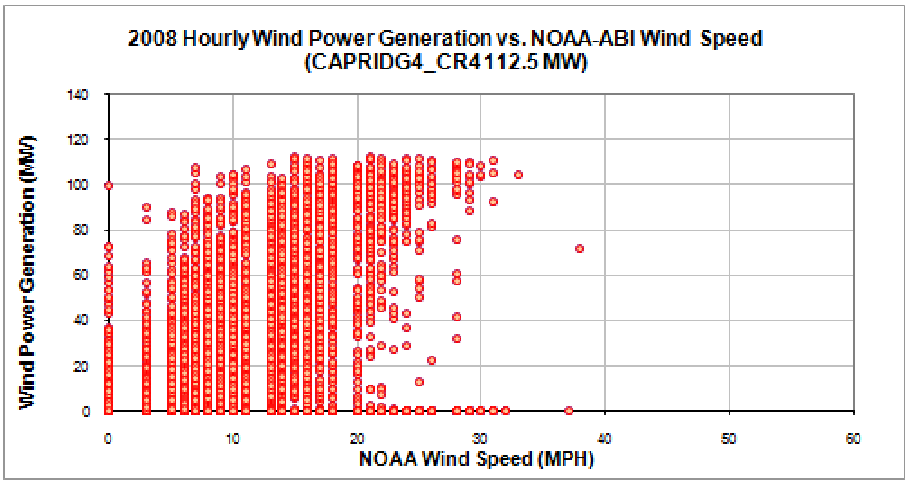

Figure 11-29: CAPRIDGE4_CR4 – Hourly Wind Power vs. NOAA Wind Speed (2008)

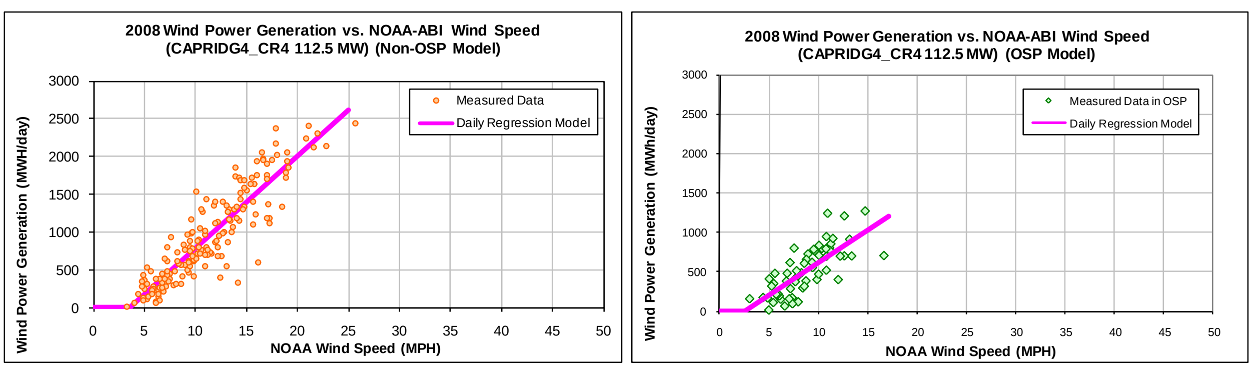

Figure 11-30: CAPRIDGE4_CR4 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-30: CAPRIDGE4_CR4 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-437.8426
Left Slope (MWh/mph-day)	122.2189
RMSE (MWh/day)	266.1010
R2	0.8096
CV-RMSE	28.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-209.8870
Left Slope (MWh/mph-day)	82.9852
RMSE (MWh/day)	195.8618
R2	0.5826
CV-RMSE	38.2%

Table 11-31: CAPRIDGE4_CR4 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08							
Mar-08							
Apr-08							
May-08	26	13.08	25,035	30,176	-20.54%	36%	43%
Jun-08	30	13.70	38,268	37,092	3.07%	47%	46%
Jul-08	30	10.64	25,308	22,640	10.54%	31%	28%
Aug-08	31	7.43	12,091	12,612	-4.31%	14%	15%
Sep-08	28	7.90	10,117	12,926	-27.76%	13%	17%
Oct-08	30	10.51	22,549	25,414	-12.71%	28%	31%
Nov-08	30	10.24	28,611	24,405	14.70%	35%	30%
Dec-08	29	11.65	31,860	28,582	10.29%	41%	37%
Total	234	10.61	193,839	193,848	0.00%	31%	31%
Total in OSP (07/15-09/15)	62	8.71	31,786	31,783	0.01%	19%	19%

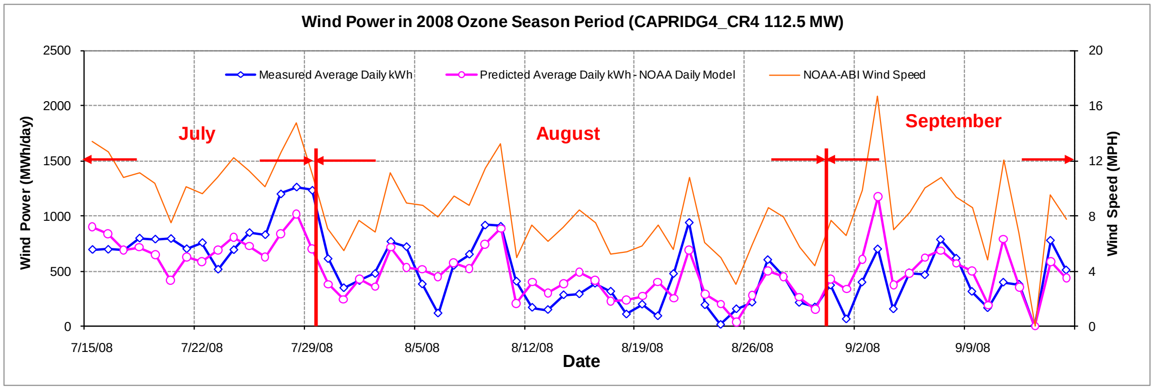

Figure 11-31: CAPRIDGE4_CR4 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

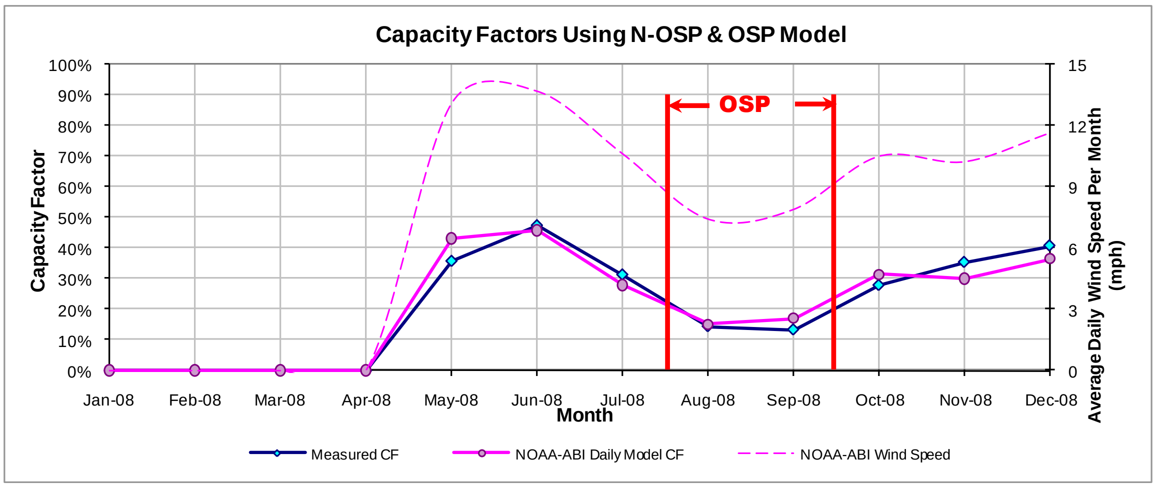

Figure 11-32: CAPRIDGE4_CR4 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-32: CAPRIDGE4_CR4 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
334,416	303,185	303,198

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
596	513	513

1999 (Jun-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jun-Dec) Measured MWh/yr	2008 (Jun-Dec) Predicted MWh/yr (2008 Daily Model)
197,349	199,638	199,647

Note: The 2008(Jun – Dec) Measured MWh/yr presented in the above table includes only validated data and it was also adjusted to 240 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.8 Capricorn Ridge Wind (CAPRIDGE_CR1)

Table 11-33: Site Information for Capricorn Ridge Wind – CAPRIDGE_CR1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDGE_CR1	WIND	ABILENE	Sterling	Sep-07	214.5	FPL Energy	Capricorn Ridge Wind	FPL Energy	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDGE_CR1	CAPRIDGE_CR1	214.5

11.8.1 Capricorn Ridge Wind – CAPRIDGE_CR1

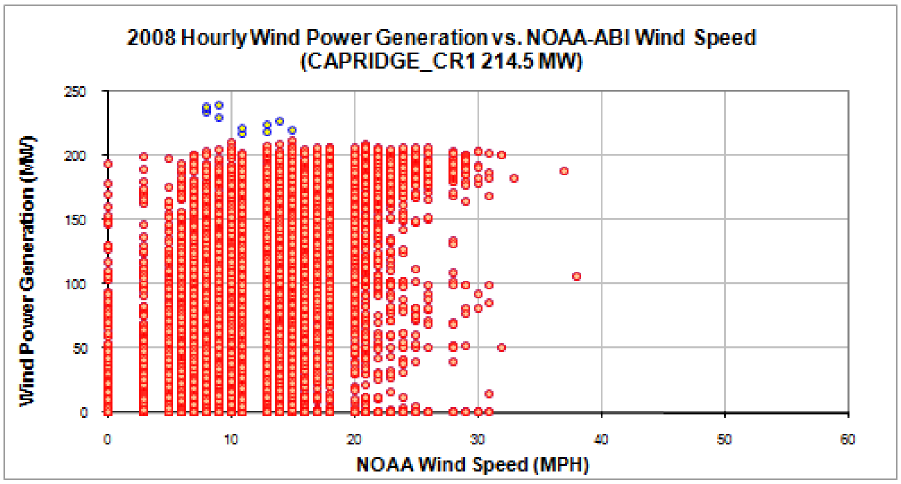

Figure 11-33: CAPRIDGE_CR1– Hourly Wind Power vs. NOAA Wind Speed (2008)

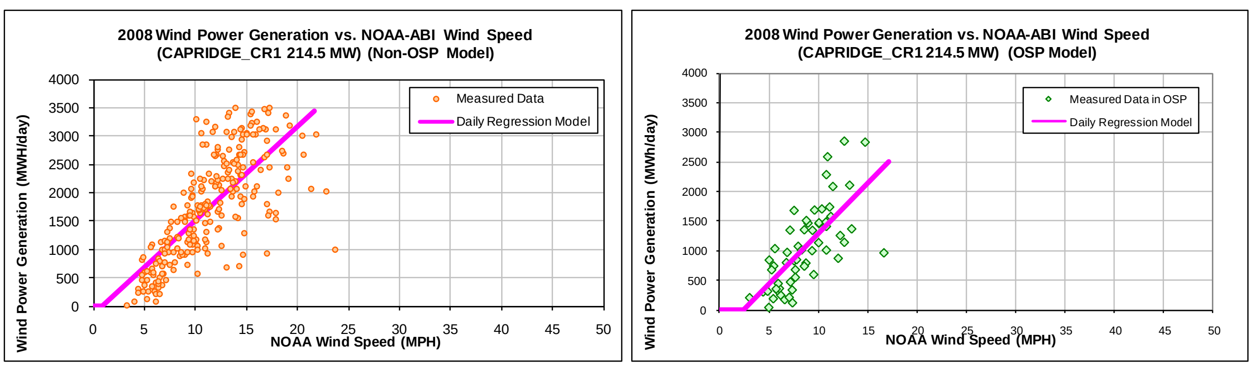

Figure 11-34: CAPRIDGE_CR1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-34: CAPRIDGE_CR1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-132.5194
Left Slope (MWh/mph-day)	165.7877
RMSE (MWh/day)	612.9941
R2	0.5469
CV-RMSE	35.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-416.3563
Left Slope (MWh/mph-day)	170.1184
RMSE (MWh/day)	479.1113
R2	0.5067
CV-RMSE	45.0%

Table 11-35: CAPRIDGE_CR1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	25	11.46	43,931	44,192	-0.59%	34%	34%
Feb-08	18	11.59	38,844	32,187	17.14%	42%	35%
Mar-08	29	13.33	66,899	60,246	9.94%	45%	40%
Apr-08	26	13.36	51,267	54,150	-5.62%	38%	40%
May-08	27	12.44	51,361	52,106	-1.45%	37%	37%
Jun-08	23	11.49	42,842	40,782	4.81%	36%	34%
Jul-08	30	10.64	51,712	44,898	13.18%	33%	29%
Aug-08	29	7.38	24,882	24,333	2.20%	17%	16%
Sep-08	27	7.82	17,220	28,268	-64.16%	12%	20%
Oct-08	27	10.03	35,998	41,302	-14.73%	26%	30%
Nov-08	27	10.04	41,957	41,356	1.43%	30%	30%
Dec-08	25	10.73	38,116	41,166	-8.00%	30%	32%
Total	313	10.81	505,028	504,987	0.01%	31%	31%
Total in OSP (07/15-09/15)	59	8.70	62,804	62,800	0.01%	21%	21%

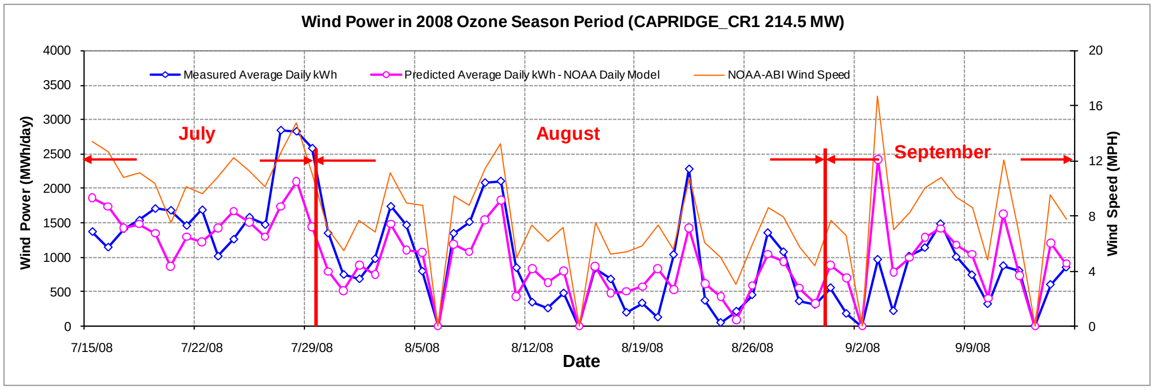

Figure 11-35: CAPRIDGE_CR1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

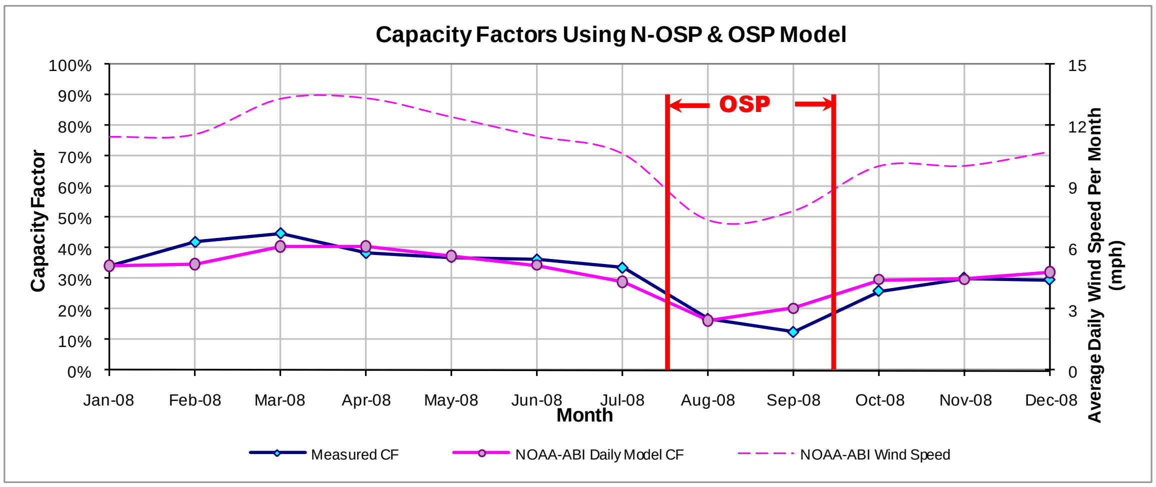

Figure 11-36: CAPRIDGE_CR1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-36: CAPRIDGE_CR1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
619,708	588,931	588,883

OSD

1999 OSD Estimated MWh/day (2007 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
1,235	1,064	1,064

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.9 Capricorn Ridge Wind (CAPRIDGE_CR2)

Table 11-37: Site Information for Capricorn Ridge Wind – CAPRIDGE_CR2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CAPRIDGE_CR2	WIND	ABILENE	Sterling	Sep-07	149.5	FPL Energy	Capricorn Ridge Wind	GE Energy	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CAPRIDGE_CR2	CAPRIDGE_CR2	149.5

11.9.1 Capricorn Ridge Wind – CAPRIDGE_CR2

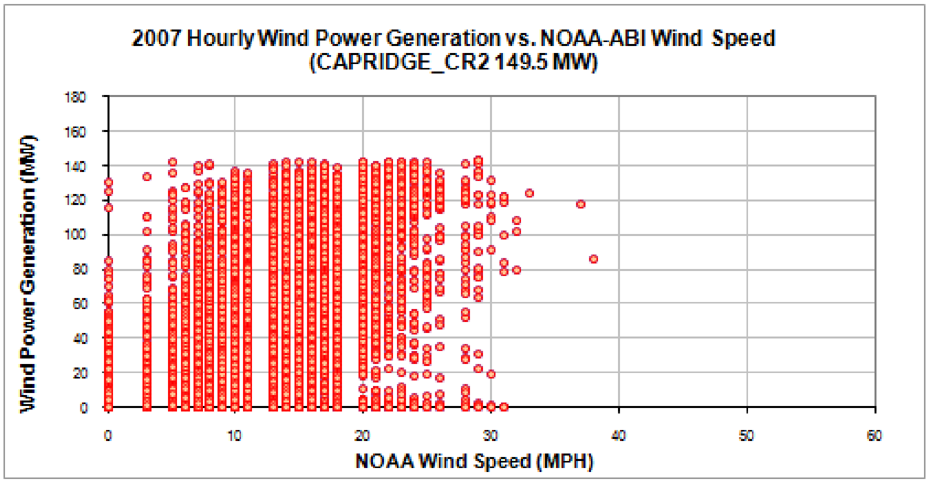

Figure 11-37: CAPRIDGE_CR2– Hourly Wind Power vs. NOAA Wind Speed (2008)

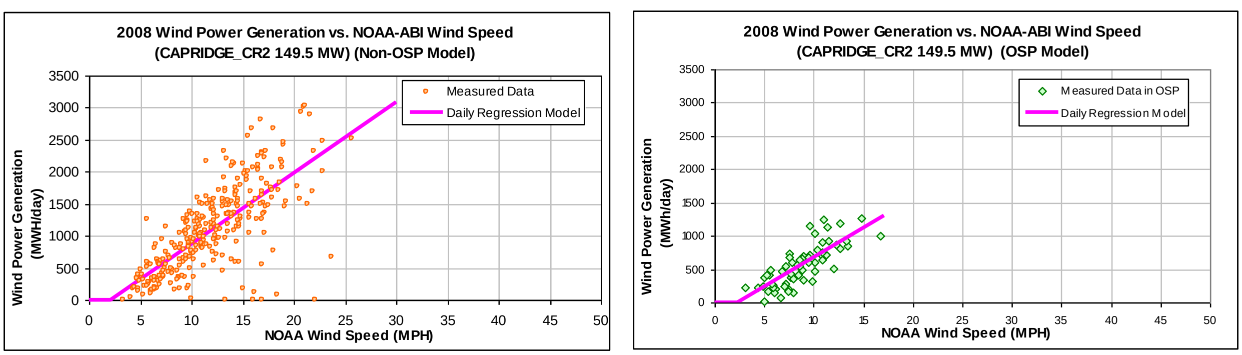

Figure 11-38: CAPRIDGE_CR2– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-38: CAPRIDGE_CR2– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-225.9312
Left Slope (MWh/mph-day)	110.6121
RMSE (MWh/day)	465.5484
R2	0.5252
CV-RMSE	42.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-205.2829
Left Slope (MWh/mph-day)	88.3485
RMSE (MWh/day)	192.9115
R2	0.6160
CV-RMSE	34.2%

Table 11-39: CAPRIDGE_CR2– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	36,047	33,512	7.03%	33%	31%
Feb-08	25	12.55	30,277	29,046	4.07%	34%	32%
Mar-08	31	13.35	42,393	38,761	8.57%	38%	35%
Apr-08	29	13.63	35,835	37,171	-3.73%	34%	36%
May-08	31	12.79	40,018	36,845	7.93%	36%	33%
Jun-08	30	13.70	45,568	38,679	15.12%	42%	36%
Jul-08	31	10.58	28,297	25,585	9.58%	25%	23%
Aug-08	31	7.43	12,948	13,991	-8.05%	12%	13%
Sep-08	30	7.95	12,819	16,851	-31.46%	12%	16%
Oct-08	31	10.48	20,711	28,917	-39.63%	19%	26%
Nov-08	30	10.24	24,083	27,198	-12.93%	22%	25%
Dec-08	31	12.20	32,422	34,831	-7.43%	29%	31%
Total	360	11.39	361,418	361,387	0.01%	28%	28%
Total in OSP (07/15-09/15)	63	8.71	35,546	35,542	0.01%	16%	16%

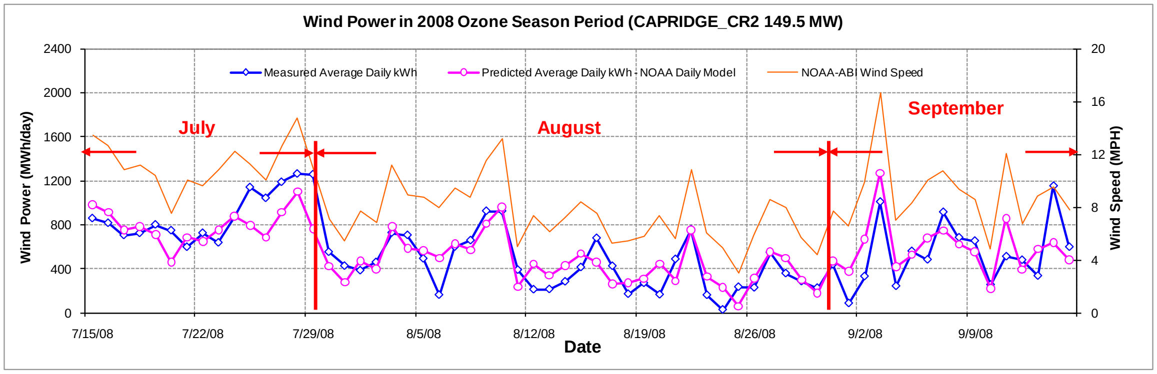

Figure 11-39: CAPRIDGE_CR2– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

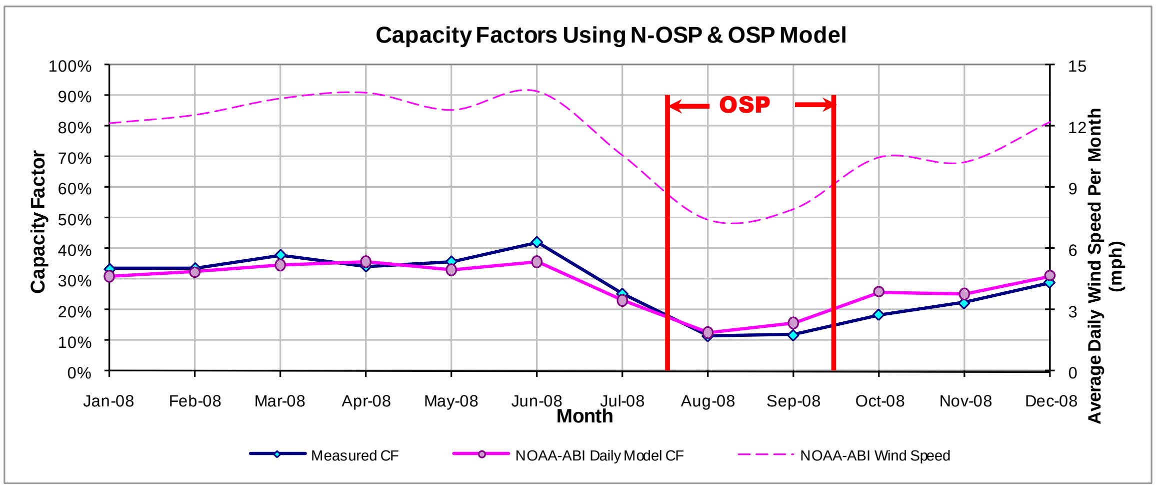

Figure 11-40: CAPRIDGE_CR2– Predicted Capacity Factors Using Daily Models (2008)

Table 11-40: CAPRIDGE_CR2– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2007 Daily Model)
361,116	367,442	367,410

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2007 Daily Model)
653	564	564

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.10 Camp Springs Wind Energy Center

Table 11-41: Site Information for Camp Springs Wind Energy Center

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CSEC_CSECG1	WIND	Lubbock	Scurry	Jul-07	130	Invenergy	Camp Springs Wind Energy Center	GE Energy	ERCOT		Oncor	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CSEC_CSECG1	CSEC_CSEC	130

11.10.1 Camp Springs Wind Energy Center – CSEC_CSECG1

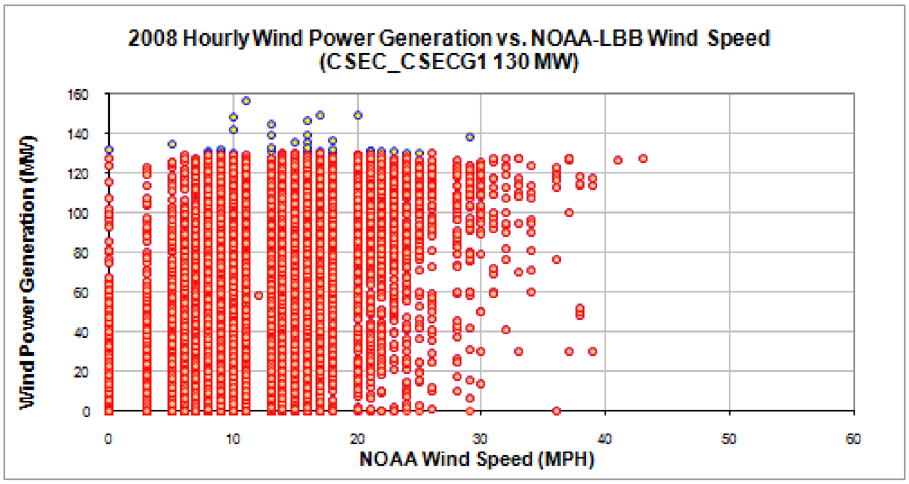
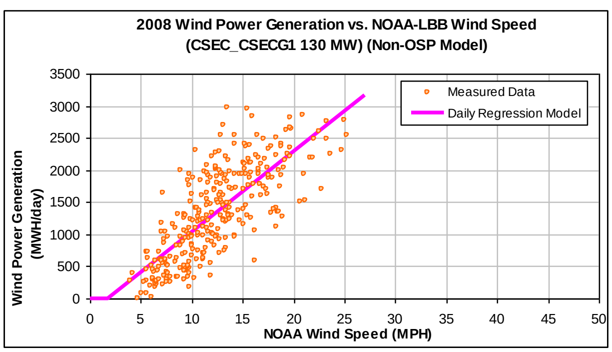


Figure 11-41: CSEC_CSECG1 – Hourly Wind Power vs. NOAA Wind Speed (2008)



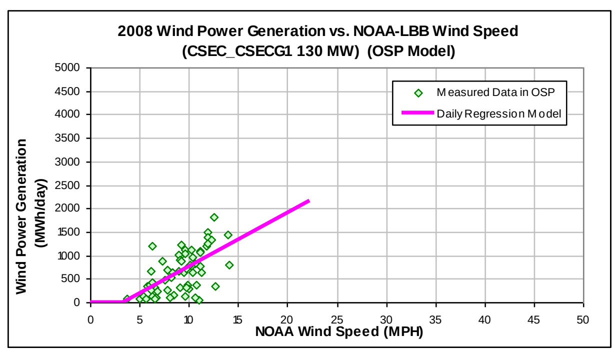


Figure 11-42: CSEC_CSECG1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-42: CSEC_CSECG1 – Model Coefficients.

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-223.3341
Left Slope (MWh/mph-day)	125.7859
RMSE (MWh/day)	468.1202
R2	0.5799
CV-RMSE	34.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-380.3771
Left Slope (MWh/mph-day)	113.7024
RMSE (MWh/day)	352.9436
R2	0.3632
CV-RMSE	55%

Table 11-43: CSEC_CSECG1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	12.74	45,698	42,762	6.42%	47%	44%
Feb-08	29	12.61	42,330	39,530	6.62%	47%	44%
Mar-08	31	14.90	48,311	51,190	-5.96%	50%	53%
Apr-08	30	14.34	46,482	47,409	-1.99%	50%	51%
May-08	31	12.95	44,508	43,585	2.07%	46%	45%
Jun-08	30	14.14	45,069	46,654	-3.52%	48%	50%
Jul-08	31	10.53	30,684	29,486	3.90%	32%	30%
Aug-08	31	8.71	14,917	18,917	-26.82%	15%	20%
Sep-08	30	7.92	17,937	19,213	-7.11%	19%	21%
Oct-08	31	10.54	33,219	34,193	-2.93%	34%	35%
Nov-08	29	10.72	32,665	32,643	0.07%	36%	36%
Dec-08	31	12.08	42,836	40,189	6.18%	44%	42%
Total	365	11.85	444,655	445,771	-0.25%	39%	39%
Total in OSP (07/15-09/15)	63	8.99	40,405	40,404	0.00%	21%	21%

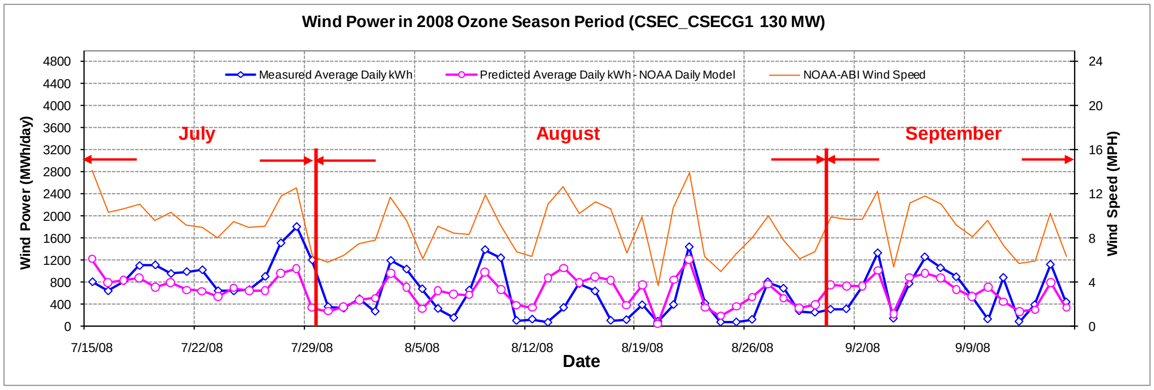


Figure 11-43: CSEC_CSECG1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

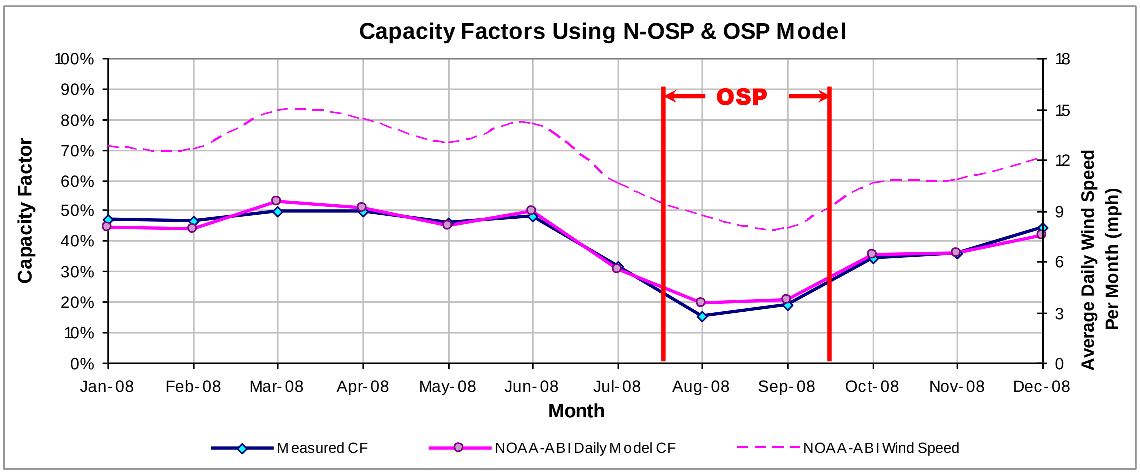


Figure 11-44: CSEC_CSECG1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-44: CSEC_CSECG1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
453,467	445,874	446,992

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2007 Daily Model)
739	641	641

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

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11.11 _Camp Springs Energy Expansion

Table 11-45: Site Information for Camp Springs Energy Expansion

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
CSEC_CSECG2	WIND	Lubbock	Scurry	Jun-08	120	Invenergy	Camp Springs Wind Energy Center		ERCOT		Oncor	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
CSEC_CSECG2	CSEC_CSEC	120

11.11.1 Camp Springs Energy Expansion – CSEC_CSECG2

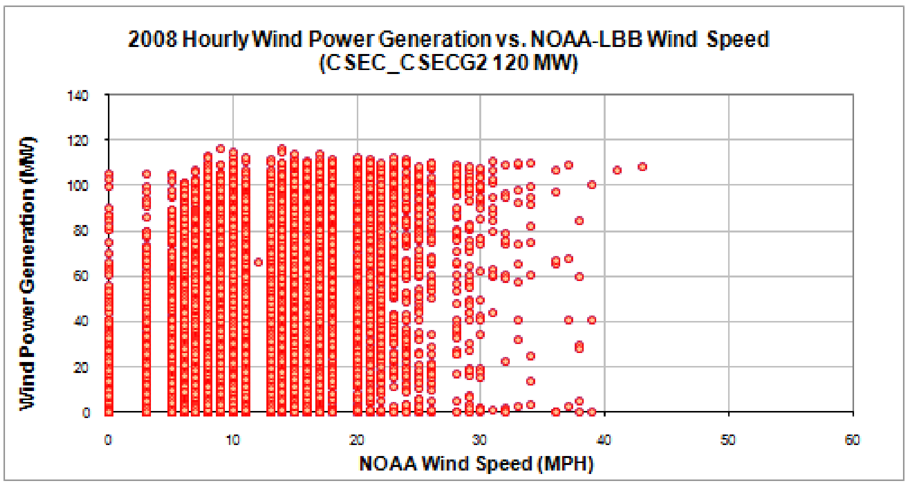

Figure 11-45: CSEC_CSECG2 – Hourly Wind Power vs. NOAA Wind Speed (2008)

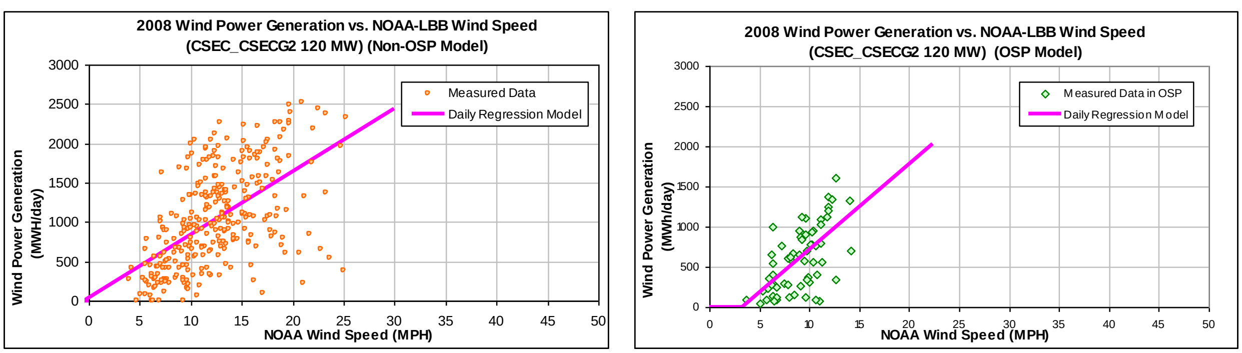

Figure 11-46: CSEC_CSECG2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model).

Table 11-46: CSEC_CSECG2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	35.5765
Left Slope (MWh/mph-day)	80.2988
RMSE (MWh/day)	506.5736
R2	0.3249
CV-RMSE	49%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-349.001
Left Slope (MWh/mph-day)	106.4238
RMSE (MWh/day)	321.5522
R2	0.3758
CV-RMSE	52.9%

Table 11-47: CSEC_CSECG2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	12.74	16,583	32,821	-97.92%	19%	37%
Feb-08	29	12.61	23,564	30,401	-29.02%	28%	36%
Mar-08	31	14.90	29,442	38,201	-29.75%	33%	43%
Apr-08	30	14.34	40,680	35,609	12.46%	47%	41%
May-08	31	12.95	39,955	33,346	16.54%	45%	37%
Jun-08	30	14.14	40,326	35,127	12.89%	47%	41%
Jul-08	31	10.53	28,237	25,012	11.42%	32%	28%
Aug-08	31	8.71	14,053	17,924	-27.54%	16%	20%
Sep-08	30	7.92	13,571	17,862	-31.61%	16%	21%
Oct-08	31	10.54	31,799	27,351	13.99%	36%	31%
Nov-08	30	10.60	32,585	26,599	18.37%	38%	31%
Dec-08	31	12.08	40,655	31,178	23.31%	46%	35%
Total	366	11.84	351,450	351,432	0.01%	33%	33%
Total in OSP (07/15-09/15)	63	8.99	38,262	38,260	0.00%	21%	21%

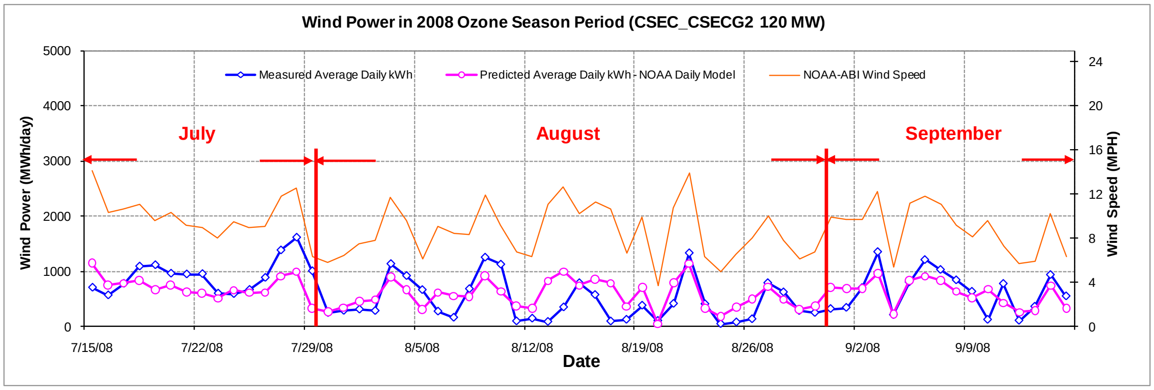

Figure 11-47: CSEC_CSECG2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

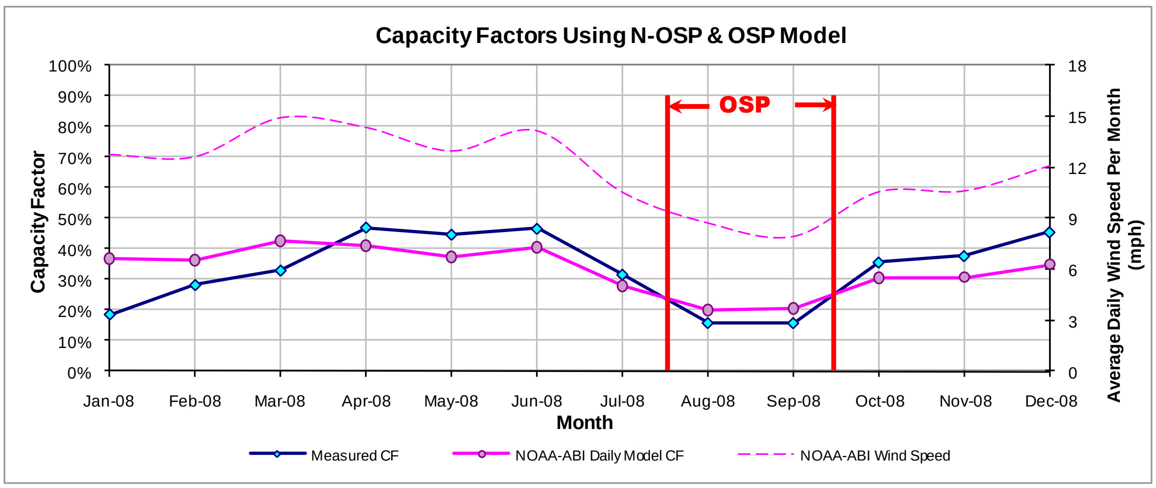

Figure 11-48: CSEC_CSECG2 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-48: CSEC_CSECG2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
357,589	351,450	351,432

1999 (Jan-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jan-Dec) Measured MWh/yr	2008 (Jan-Dec) Predicted MWh/yr (2008 Daily Model)
357,589	351,450	351,432

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
699	607	607

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.12 Delaware Mountain Wind Farm

Table 11-49: Site Information for Delaware Mountain Wind Farm

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
DELAWARE	WIND		CULBERSON	Jun-99	28.5	American National Wind Power	Delaware Mountain Wind Farm	Zond (40)	ERCOT	TXU	TXU	GDP	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
DELAWARE_WIND_NWP	DELAWARE	28.5

11.12.1 Delaware Mountain Wind Farm – DELAWARE_WIND_NWP

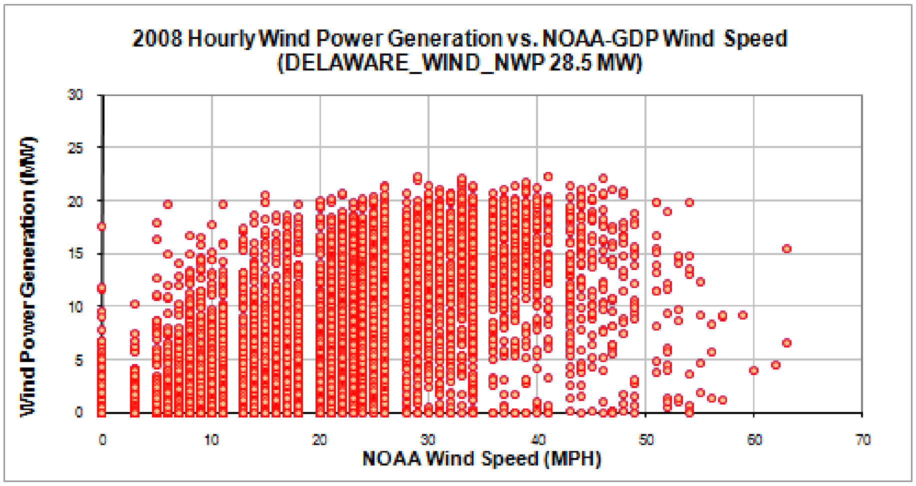

Figure 11-49: DELAWARE_WIND_NWP – Hourly Wind Power vs. NOAA Wind Speed (2008)

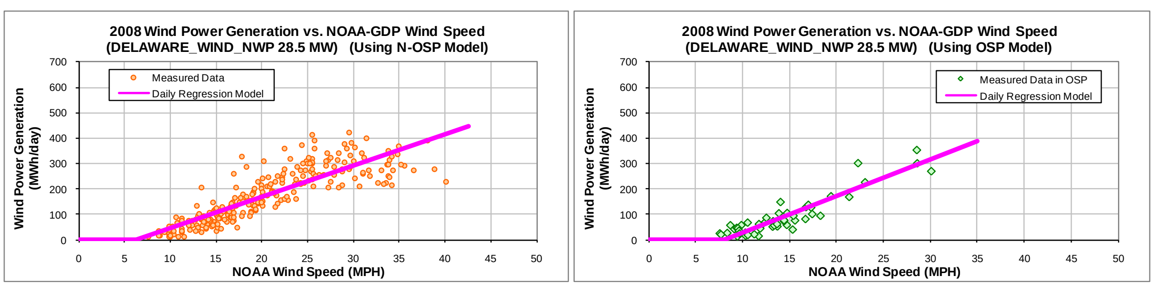

Figure 11-50: DELAWARE_WIND_NWP – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-50: DELAWARE_WIND_NWP – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-76.6408
Left Slope (MWh/mph-day)	12.2908
RMSE (MWh/day)	54.1676
R2	0.7327
CV-RMSE	31.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-115.9255
Left Slope (MWh/mph-day)	14.3428
RMSE (MWh/day)	32.8956
R2	0.8453
CV-RMSE	35.8%

Table 11-51: DELAWARE_WIND_NWP – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	20.92	5,481	5,416	1.19%	27%	26%
Feb-08	28	24.79	6,789	6,385	5.95%	35%	33%
Mar-08	27	21.01	5,442	4,904	9.90%	29%	27%
Apr-08	29	22.07	5,081	5,643	-11.05%	26%	28%
May-08	25	19.64	4,068	4,119	-1.26%	24%	24%
Jun-08	28	19.21	3,988	4,464	-11.94%	21%	23%
Jul-08	18	14.89	1,762	1,771	-0.50%	14%	14%
Aug-08	24	14.25	1,995	2,134	-6.95%	12%	13%
Sep-08	15	14.27	1,255	1,379	-9.92%	12%	13%
Oct-08	29	15.51	2,936	3,306	-12.59%	15%	17%
Nov-08	30	17.79	4,360	4,261	2.27%	21%	21%
Dec-08	27	24.36	6,628	6,013	9.28%	36%	33%
Total	310	19.43	49,786	49,795	-0.02%	23%	23%
Total in OSP (07/15-09/15)	51	14.50	4,691	4,702	-0.23%	13%	13%

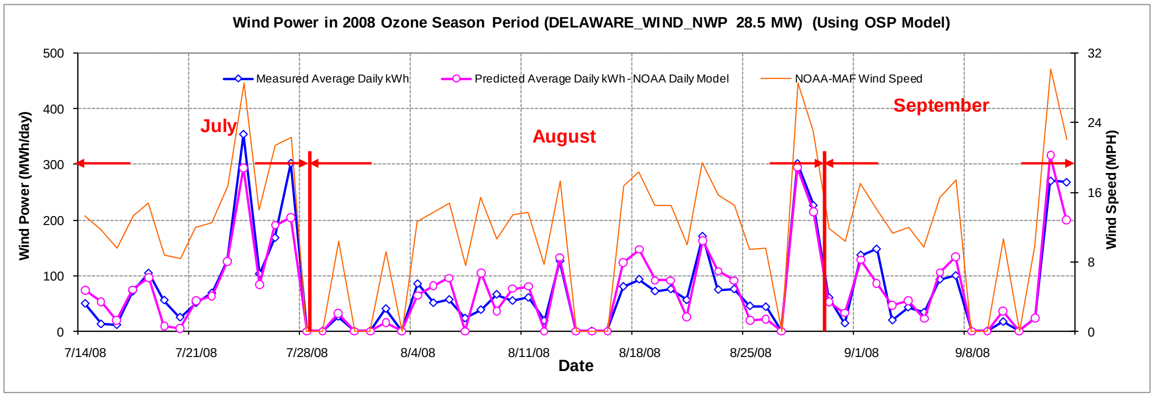

Figure 11-51: DELAWARE_WIND_NWP – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

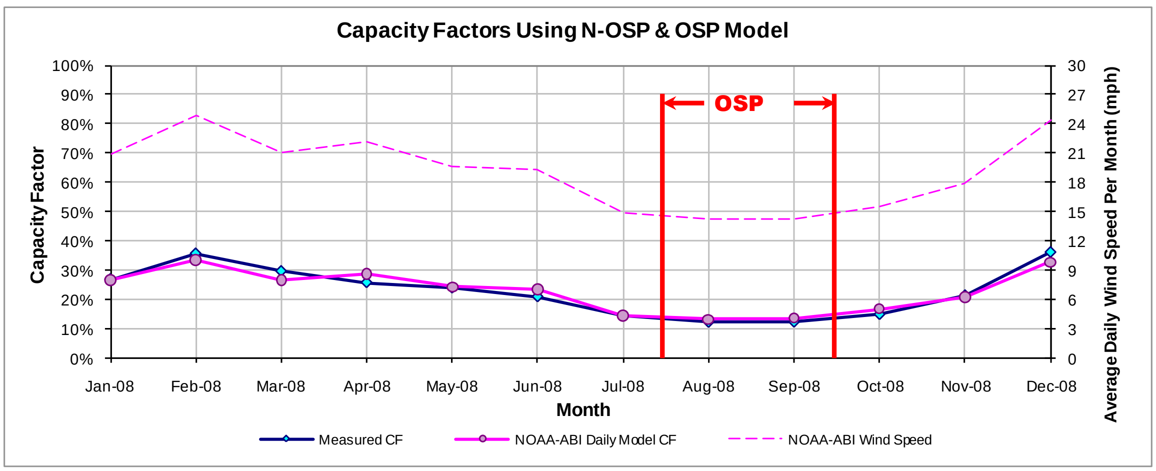

Figure 11-52: DELAWARE_WIND_NWP – Predicted Capacity Factors Using Daily Models (2008)

Table 11-52: DELAWARE_WIND_NWP – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2007 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
53,626	58,780	58,790

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
84	92	92

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.13 Snyder Wind Project

Table 11-53: Site Information for Snyder Wind Project

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
ENAS_ENA1	WIND	Snyder	Scurry	Dec-07	63	Enel North America/WKN USA	Snyder Wind Project	Vestas (21)	ERCOT		BCEC	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
ENAS_ENA1	ENAS_ENA1	63

11.13.1 Snyder Wind Project – ENAS_ENA1

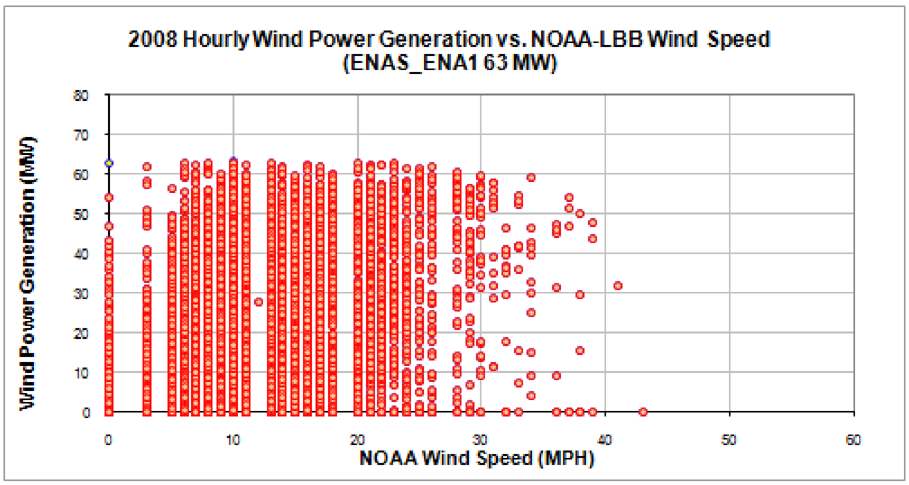

Figure 11-53: ENAS_ENA1– Hourly Wind Power vs. NOAA Wind Speed (2008)

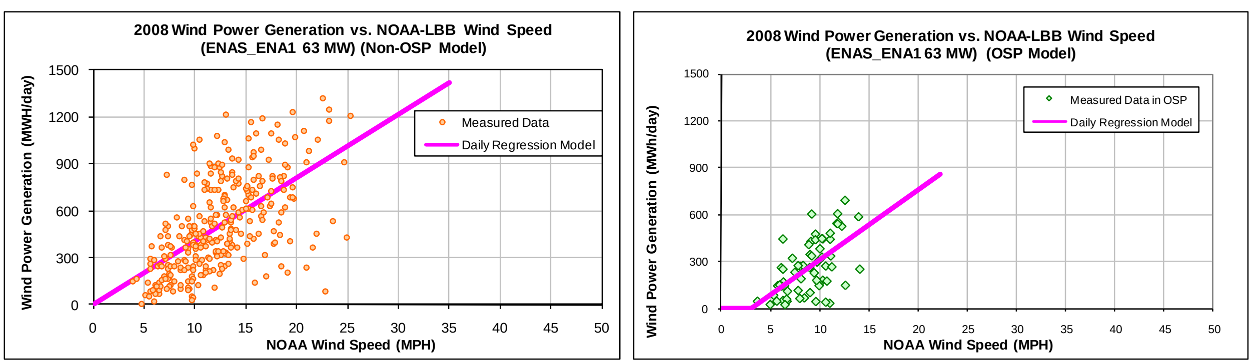

Figure 11-54: ENAS_ENA1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-54: ENAS_ENA1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	0.5508
Left Slope (MWh/mph-day)	40.6127
RMSE (MWh/day)	239.5043
R2	0.3551
CV-RMSE	47.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-134.3094
Left Slope (MWh/mph-day)	44.403
RMSE (MWh/day)	145.4246
R2	0.3388
CV-RMSE	54.9%

Table 11-55: ENAS_ENA1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	12.74	16,715	16,059	3.93%	36%	34%
Feb-08	29	12.61	13,390	14,870	-11.06%	31%	34%
Mar-08	31	14.90	12,661	18,780	-48.33%	27%	40%
Apr-08	30	14.34	16,003	17,487	-9.27%	35%	39%
May-08	31	12.95	16,555	16,325	1.39%	35%	35%
Jun-08	30	14.14	18,945	17,243	8.98%	42%	38%
Jul-08	31	10.53	11,735	11,592	1.22%	25%	25%
Aug-08	31	8.71	6,450	7,829	-21.38%	14%	17%
Sep-08	30	7.92	7,052	8,148	-15.54%	16%	18%
Oct-08	31	10.54	14,867	13,292	10.59%	32%	28%
Nov-08	30	10.60	17,522	12,930	26.21%	39%	29%
Dec-08	31	12.08	17,897	15,228	14.91%	38%	32%
Total	366	11.84	169,792	169,783	0.01%	31%	31%
Total in OSP (07/15-09/15)	63	8.99	16,676	16,675	0.00%	18%	18%

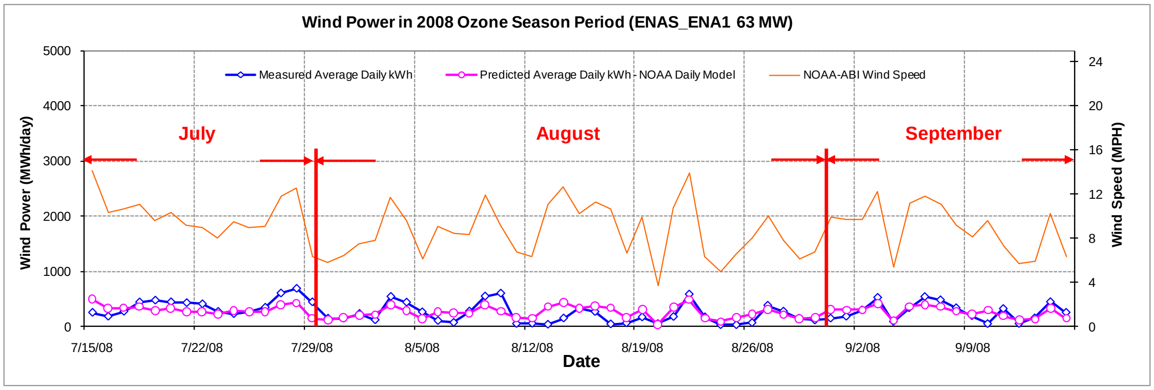

Figure 11-55: ENAS_ENA1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

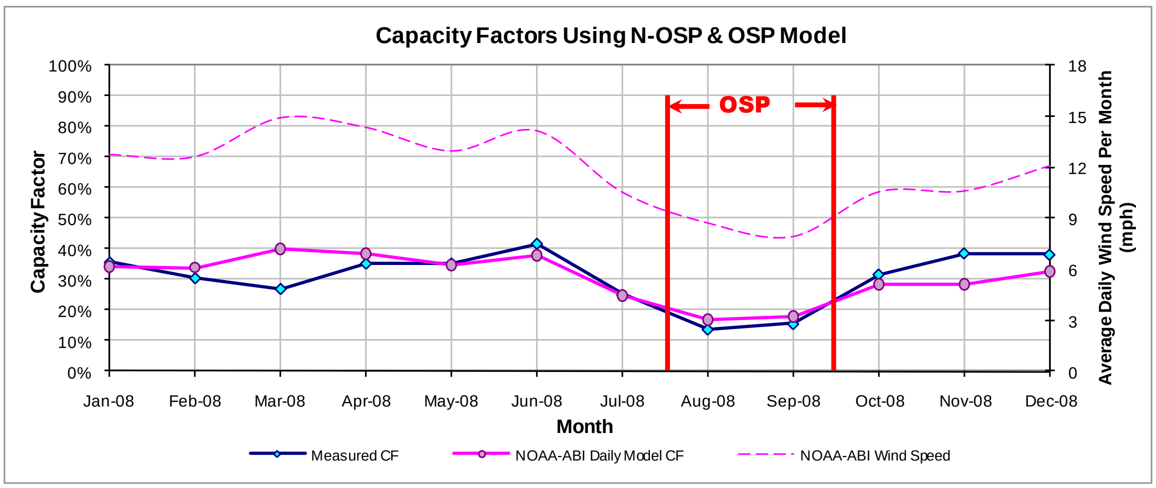

Figure 11-56: ENAS_ENA1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-56: ENAS_ENA1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
172,403	169,792	169,783

1999 (Jan-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jan-Dec) Measured MWh/yr	2008 (Jan-Dec) Predicted MWh/yr (2008 Daily Model)
172,403	169,792	169,783

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2007 Daily Model)
303	265	265

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.14 Silver Star Phase 1

Table 11-57: Site Information for Silver Star Phase 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
FLTCK_SSI	WIND		Erath	Mar-08	60	BP/Clipper Windpower	Silver Star Phase I	Clipper Windpower(24)	ERCOT	AEP-West	ONCOR	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
FLTCK_SSI	FLTCK_SSI	60

11.14.1 Silver Star Phase1 – FLTCK_SSI

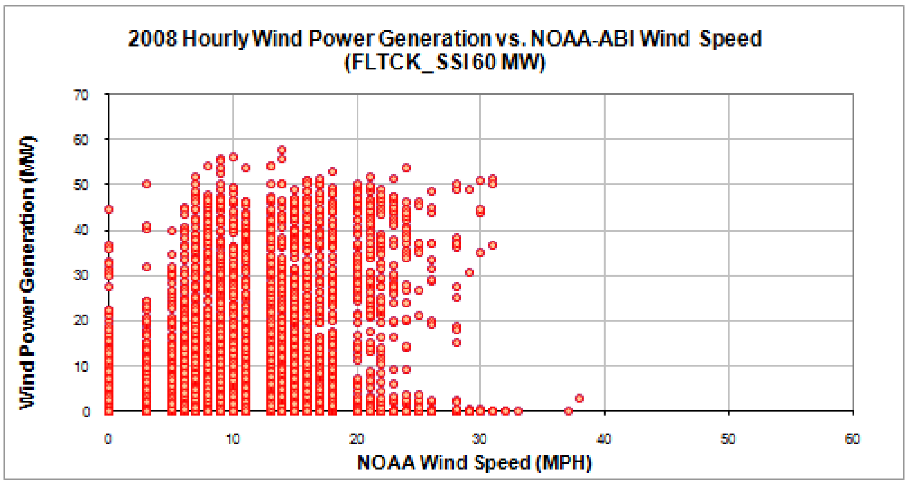

Figure 11-57: FLTCK_SSI – Hourly Wind Power vs. NOAA Wind Speed (2008)

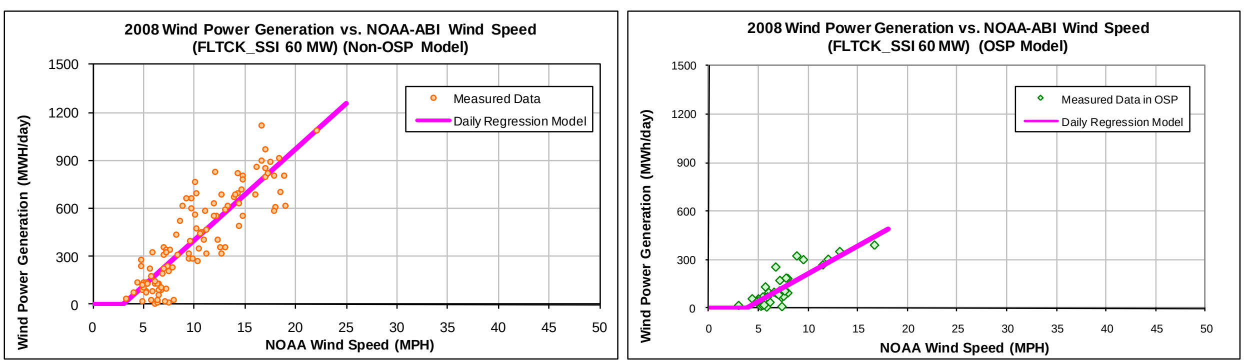

Figure 11-58: FLTCK_SSI – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-58: FLTCK_SSI – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-164.9272
Left Slope (MWh/mph-day)	56.8666
RMSE (MWh/day)	141.7138
R2	0.7608
CV-RMSE	33.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-127.5927
Left Slope (MWh/mph-day)	34.2458
RMSE (MWh/day)	58.2333
R2	0.7165
CV-RMSE	47.5%

Table 11-59: FLTCK_SSI – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08							
Mar-08							
Apr-08							
May-08							
Jun-08	5	6.72	77	1,085	-1307.48%	1%	15%
Jul-08	5	6.97	384	813	-111.81%	5%	11%
Aug-08	23	6.76	2,053	2,415	-17.60%	6%	7%
Sep-08	22	7.45	3,824	4,209	-10.05%	12%	13%
Oct-08	30	10.51	13,844	12,975	6.28%	32%	30%
Nov-08	27	10.33	11,867	11,403	3.91%	31%	29%
Dec-08	29	12.46	16,599	15,770	5.00%	40%	38%
Total	141	9.53	48,648	48,668	-0.04%	24%	24%
Total in OSP (07/15-09/15)	35	7.31	4,294	4,318	-0.56%	9%	9%

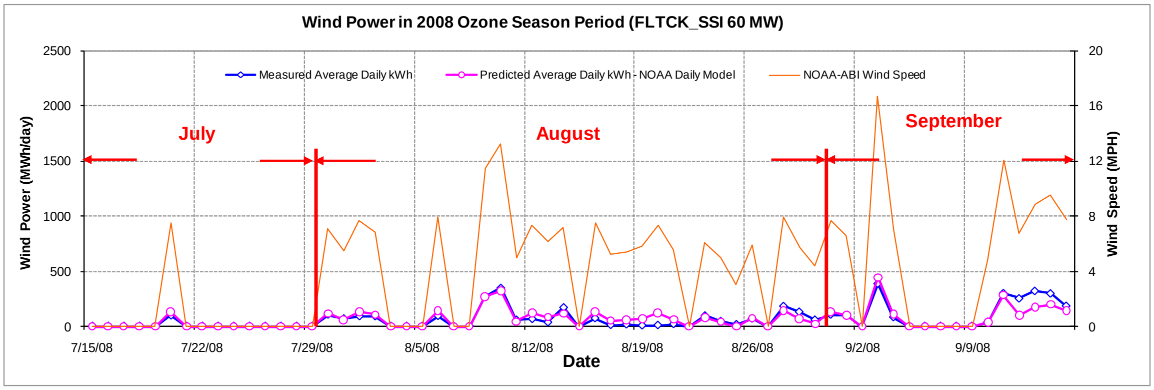

Figure 11-59: FLTCK_SSI – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

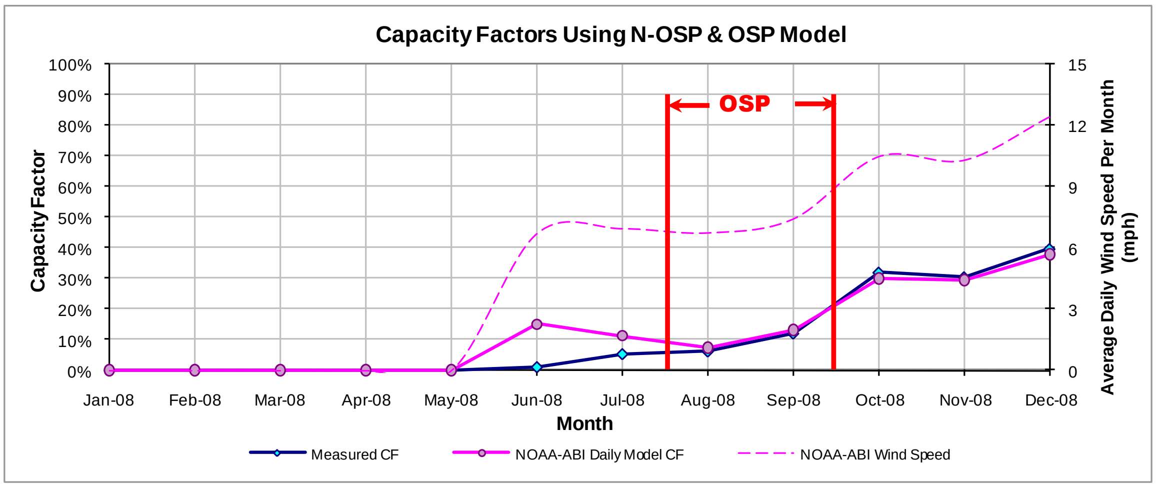

Figure 11-60: FLTCK_SSI – Predicted Capacity Factors Using Daily Models (2008)

Table 11-60: FLTCK_SSI - Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
162,719	126,279	126,331

1999 (Jun-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jun-Dec) Measured MWh/yr	2008 (Jun-Dec) Predicted MWh/yr (2008 Daily Model)
70,884	67,970	67,998

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
205	123	123

Note: The 2008(Jun – Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 197 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.15 Goat Wind and Goat Wind Phase 2

Table 11-61: Site Information for Goat Wind and Goat Wind Phase 2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
GOAT_GOATWIND	WIND		Sterling	Apr-08	150	Edison Mission Group	Goat Wind & Goat Wind Phase 2	Clipper Windpower(24)	ERCOT	LCRA	LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
GOAT_GOATWIND	GOAT_GOATWIND	150

11.15.1 Goat Wind and Goat Wind Phase 2 – GOAT_GOATWIND

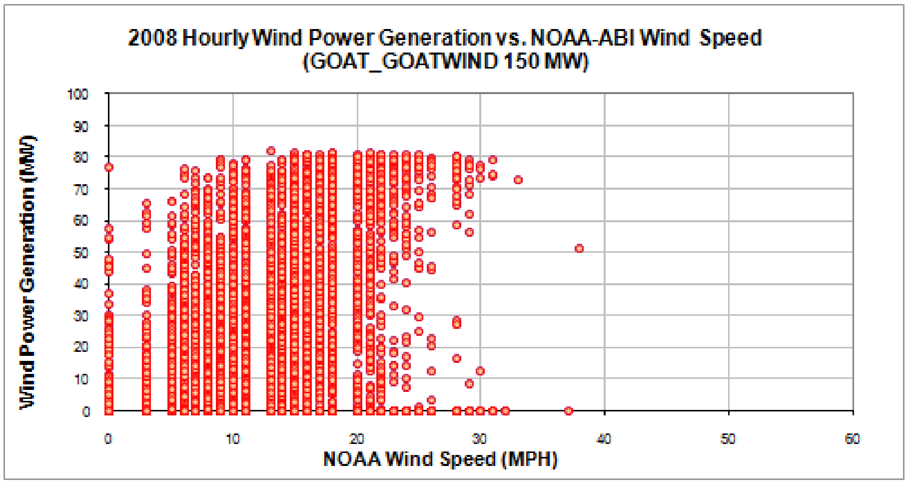

Figure 11-61: GOAT_GOATWIND – Hourly Wind Power vs. NOAA Wind Speed (2008)

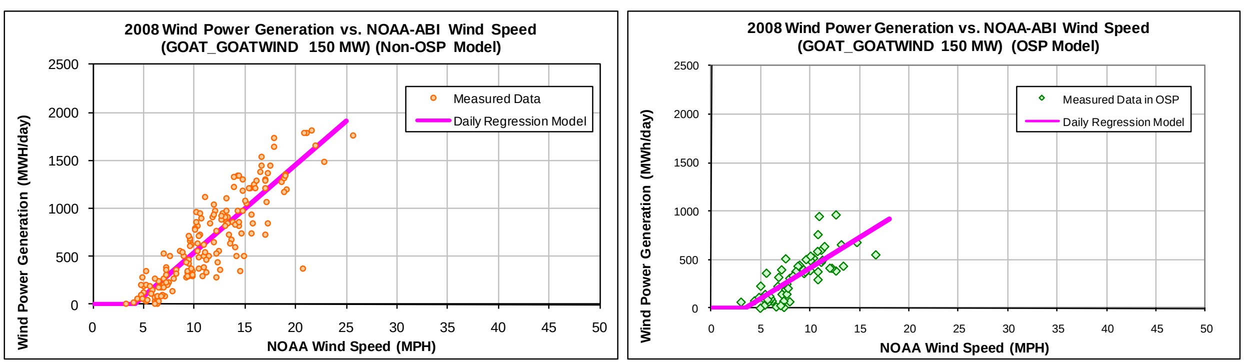

Figure 11-62: GOAT_GOATWIND – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-62: GOAT_GOATWIND – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-376.278
Left Slope (MWh/mph-day)	91.2665
RMSE (MWh/day)	222.7797
R2	0.7743
CV-RMSE	33.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-211.946
Left Slope (MWh/mph-day)	62.6896
RMSE (MWh/day)	150.4456
R2	0.5904
CV-RMSE	45.2%

Table 11-63: GOAT_GOATWIND – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08							
Mar-08							
Apr-08	6	14.33	2,790	5,589	-100.32%	13%	26%
May-08	29	12.99	21,778	23,476	-7.80%	21%	22%
Jun-08	30	13.70	26,188	26,218	-0.12%	24%	24%
Jul-08	29	10.70	16,304	15,035	7.78%	16%	14%
Aug-08	29	7.35	7,103	7,244	-1.99%	7%	7%
Sep-08	26	7.80	5,643	7,556	-33.89%	6%	8%
Oct-08	25	9.68	13,646	12,755	6.53%	15%	14%
Nov-08	29	10.31	18,760	16,384	12.67%	18%	16%
Dec-08	27	11.88	21,081	19,122	9.29%	22%	20%
Total	230	10.70	133,292	133,380	-0.07%	16%	16%
Total in OSP (07/15-09/15)	58	8.69	19,316	19,338	-0.11%	9%	9%

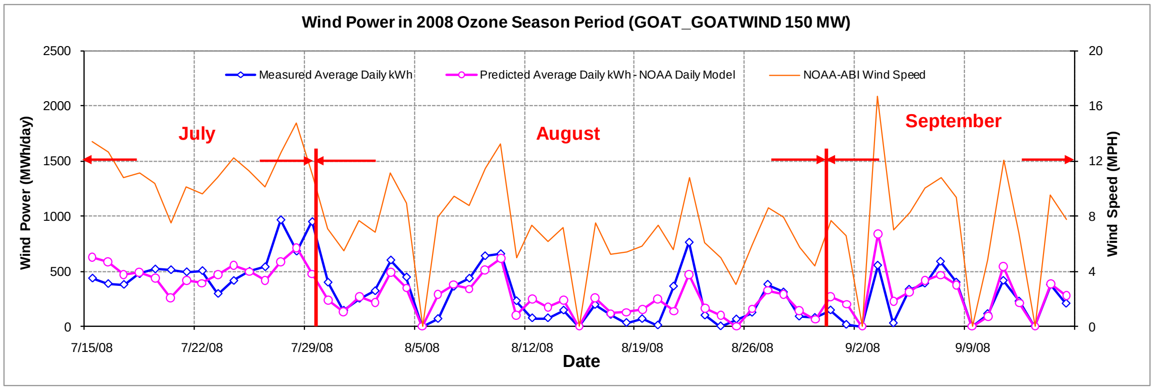

Figure 11-63: GOAT_GOATWIND – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

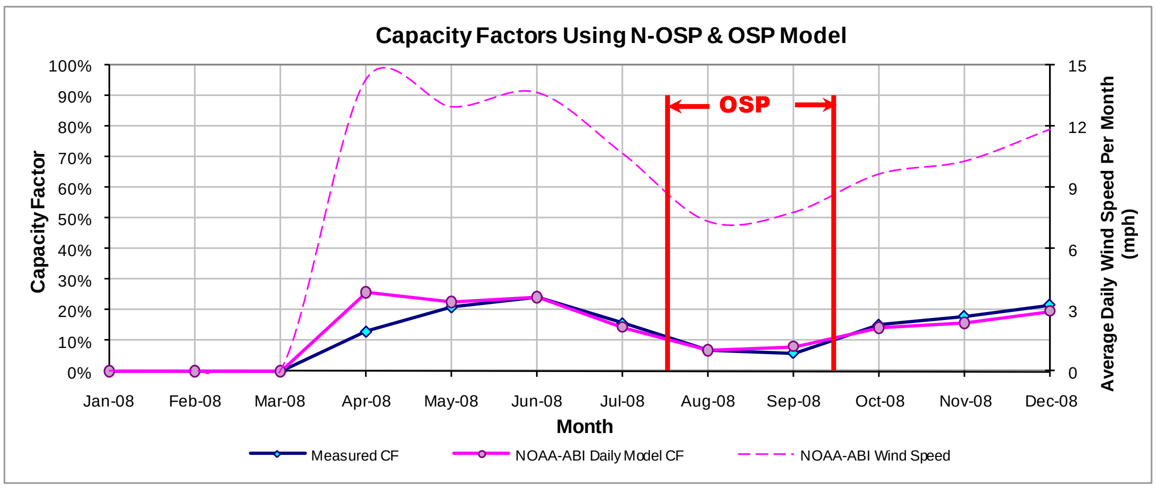

Figure 11-64: GOAT_GOATWIND - Predicted Capacity Factors Using Daily Models (2008)

Table 11-64: GOAT_GOATWIND – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
231,910	212,109	212,247

1999 (Apr-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Apr-Dec) Measured MWh/yr	2008 (Apr-Dec) Predicted MWh/yr (2008 Daily Model)
157,421	153,576	153,676

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
397	333	333

Note: The 2008 (Apr – Dec) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 265 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.16 Horse Hollow Phase 1

Table 11-65: Site Information for Horse Hollow Phase 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
H_HOLLOW	WIND	Abilene	TAYLOR	Oct-05	213	FPL Energy	Horse Hollow 1	GE Energy 1.5 MW (142)	ERCOT	AEP-West	AEP-TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
H_HOLLOW_WND1	H_HOLLOW	213

11.16.1 Horse Hollow Phase 1 – H_HOLLOW_WND1

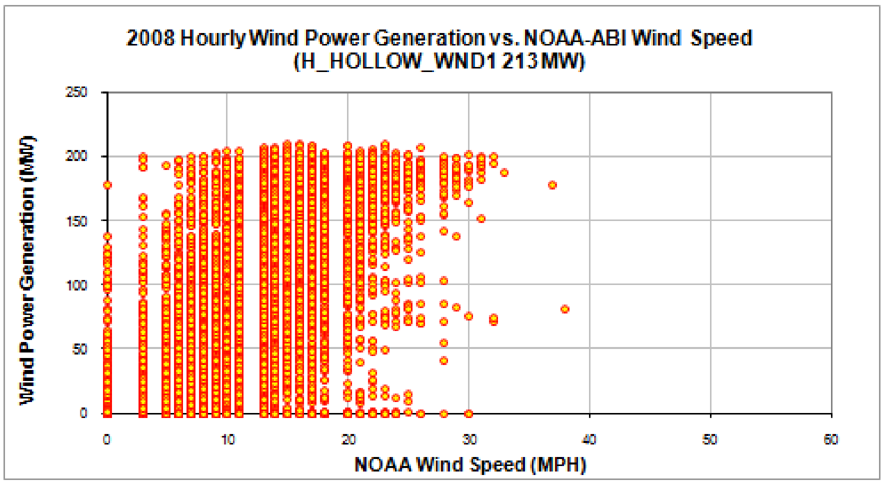

Figure 11-65: H_HOLLOW_WND1– Hourly Wind Power vs. NOAA Wind Speed (2008)

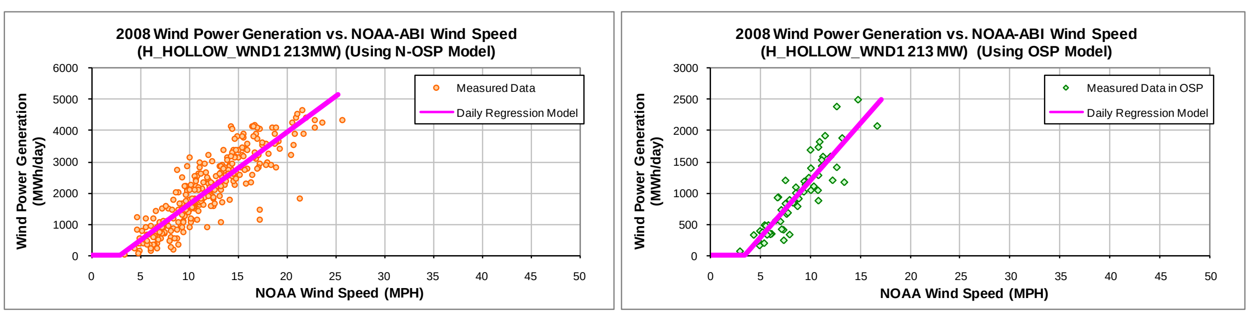

Figure 11-66: H_HOLLOW_WND1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-66: H_HOLLOW_WND1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-669.8516
Left Slope (MWh/mph-day)	231.4101
RMSE (MWh/day)	549.5259
R2	0.77
CV-RMSE	26.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-638.4771
Left Slope (MWh/mph-day)	183.4218
RMSE (MWh/day)	259.4273
R2	0.7926
CV-RMSE	27%

Table 11-67: H_HOLLOW_WND1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	58,423	64,195	-9.88%	38%	42%
Feb-08	29	12.36	65,148	63,533	2.48%	44%	43%
Mar-08	31	13.35	80,241	74,979	6.56%	51%	47%
Apr-08	30	13.87	74,727	76,169	-1.93%	49%	50%
May-08	31	12.79	71,147	70,969	0.25%	45%	45%
Jun-08	30	13.70	75,154	75,004	0.20%	49%	49%
Jul-08	31	10.58	44,975	46,957	-4.41%	28%	30%
Aug-08	31	7.43	22,098	22,554	-2.06%	14%	14%
Sep-08	28	8.18	24,281	28,147	-15.92%	17%	20%
Oct-08	26	9.20	36,409	37,920	-4.15%	27%	29%
Nov-08	28	9.72	49,131	44,254	9.93%	34%	31%
Dec-08	29	11.77	62,506	59,582	4.68%	42%	40%
Total	354	11.30	664,241	664,263	0.00%	37%	37%
Total in OSP (07/15-09/15)	63	8.71	60,423	60,504	-0.13%	19%	19%

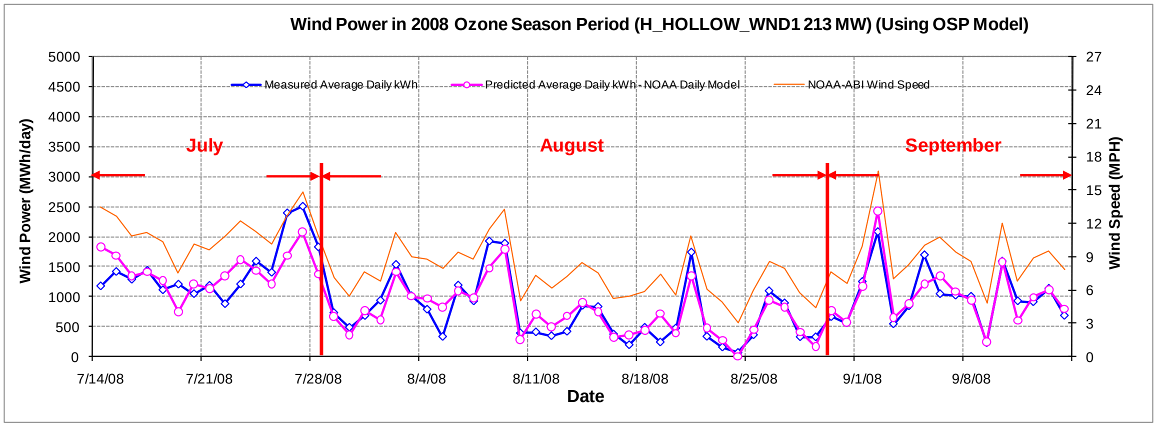

Figure 11-67: H_HOLLOW_WND1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

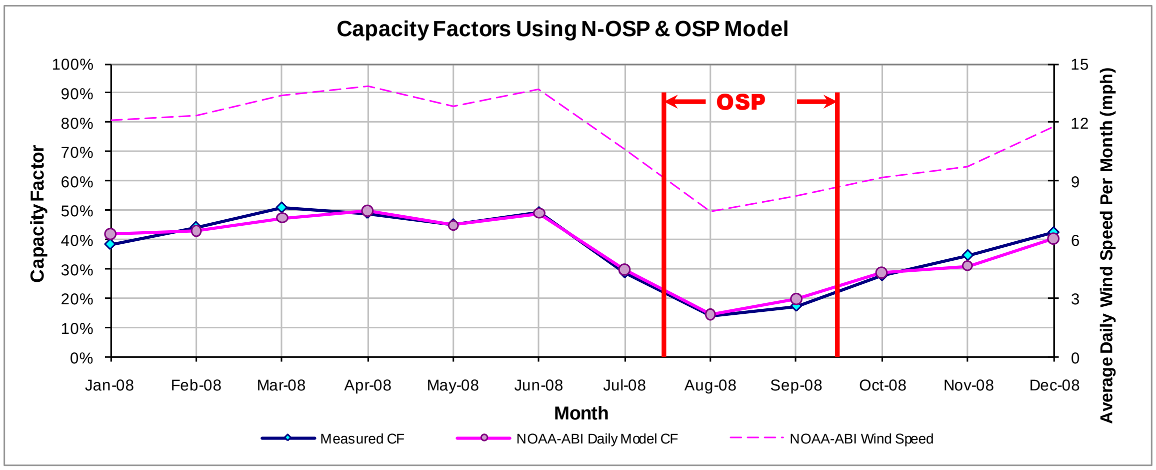

Figure 11-68: H_HOLLOW_WND1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-68: H_HOLLOW_WND1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
681,991	686,757	686,780

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
1,142	959	960

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.17 Horse Hollow Phase 2

Table 11-69: Site Information for Horse Hollow Phase 2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
HHOLLOW2_WIND1	WIND	Abilene	Taylor	Jul-06	184	FPL Energy	Horse Hollow Phase 2	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HHOLLOW2_WIND1	HHOLLOW2_WIND1	184

11.17.1 Horse Hollow Phase 2 – HHOLLOW2_WIND1

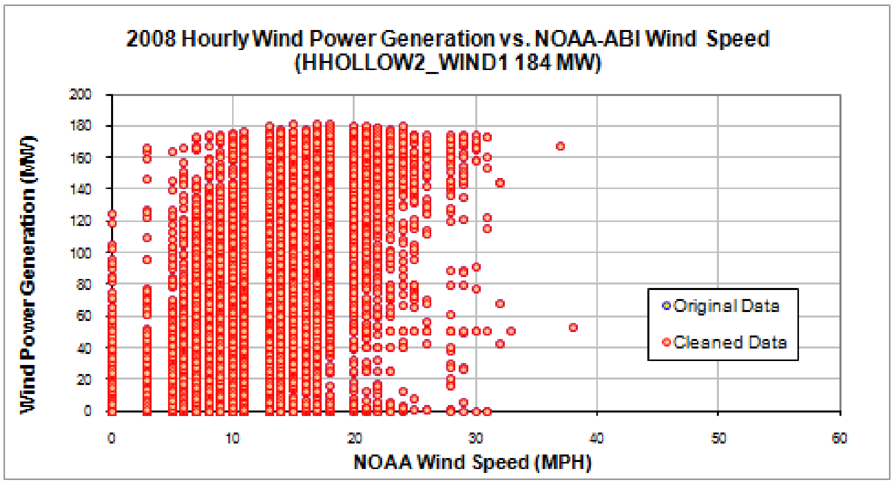

Figure 11-69: HHOLLOW2_WIND1– Hourly Wind Power vs. NOAA Wind Speed (2008)

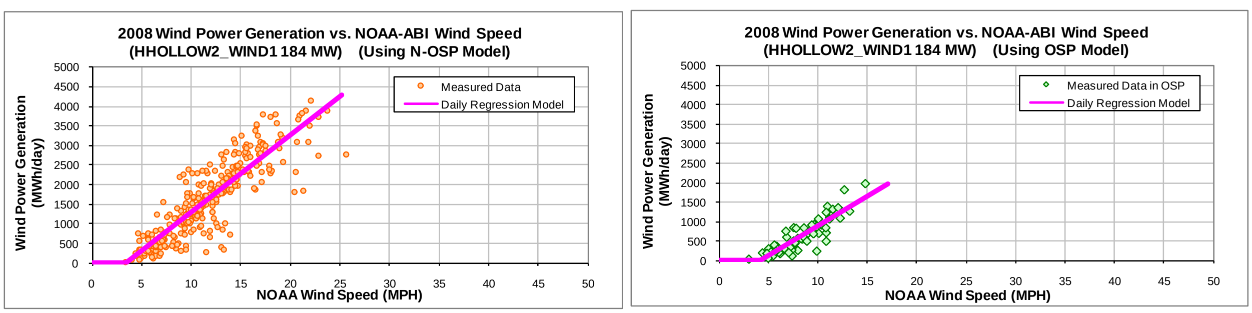

Figure 11-70: HHOLLOW2_WIND1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-70: HHOLLOW2_WIND1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-678.1911
Left Slope (MWh/mph-day)	196.7504
RMSE (MWh/day)	487.7792
R2	0.759
CV-RMSE	29.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-641.5896
Left Slope (MWh/mph-day)	153.5436
RMSE (MWh/day)	214.7027
R2	0.7604
CV-RMSE	32.9%

Table 11-71: HHOLLOW2_WIND1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	28	12.01	44,154	47,187	-6.87%	36%	38%
Feb-08	28	12.53	49,402	50,063	-1.34%	40%	40%
Mar-08	31	13.35	62,127	60,380	2.81%	45%	44%
Apr-08	30	13.87	61,727	61,500	0.37%	47%	46%
May-08	30	12.74	58,090	54,862	5.56%	44%	41%
Jun-08	30	13.70	59,701	60,510	-1.36%	45%	46%
Jul-08	23	10.31	21,905	24,904	-13.69%	22%	25%
Aug-08	31	7.43	15,249	15,667	-2.74%	11%	11%
Sep-08	29	7.65	16,476	19,264	-16.92%	13%	15%
Oct-08	28	9.84	33,316	35,254	-5.82%	27%	29%
Nov-08	28	9.76	33,525	34,763	-3.69%	27%	28%
Dec-08	27	11.26	50,047	41,517	17.04%	42%	35%
Total	343	11.23	505,720	505,872	-0.03%	33%	33%
Total in OSP (07/15-09/15)	60	8.43	39,185	39,362	-0.45%	15%	15%

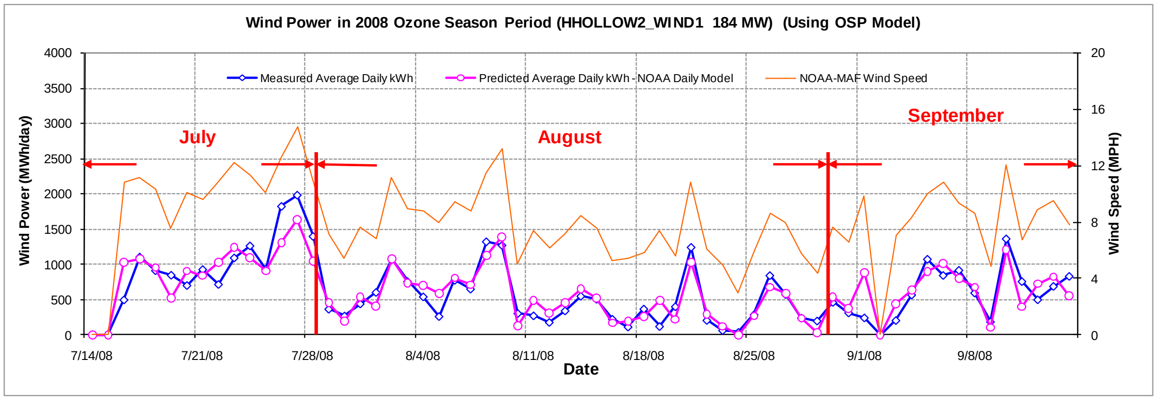

Figure 11-71: HHOLLOW2_WIND1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

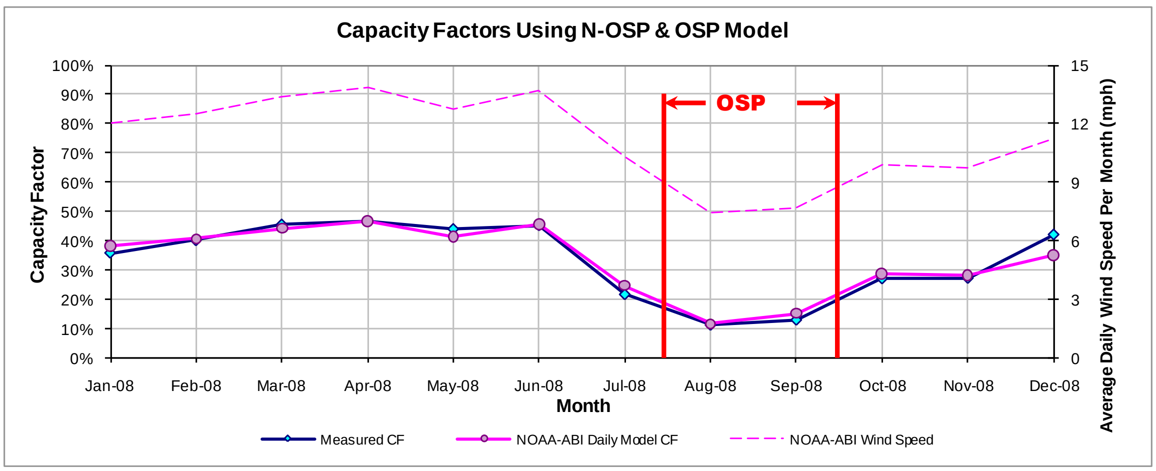

Figure 11-72: HHOLLOW2_WIND1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-72: HHOLLOW2_WIND1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2007 Daily Model)
539,444	539,631	539,794

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
849	653	656

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.18 Horse Hollow Phase 3

Table 11-73: Site Information for Horse Hollow Phase 3

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
HHOLLOW3_WND_1	WIND	Abilene	Taylor	May-06	160	FPL Energy	Horse Hollow Phase 4	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HHOLLOW3_WND_1	HHOLLOW3_WND_1	299

11.18.1 Horse Hollow Phase 3– HHOLLOW3_WND_3

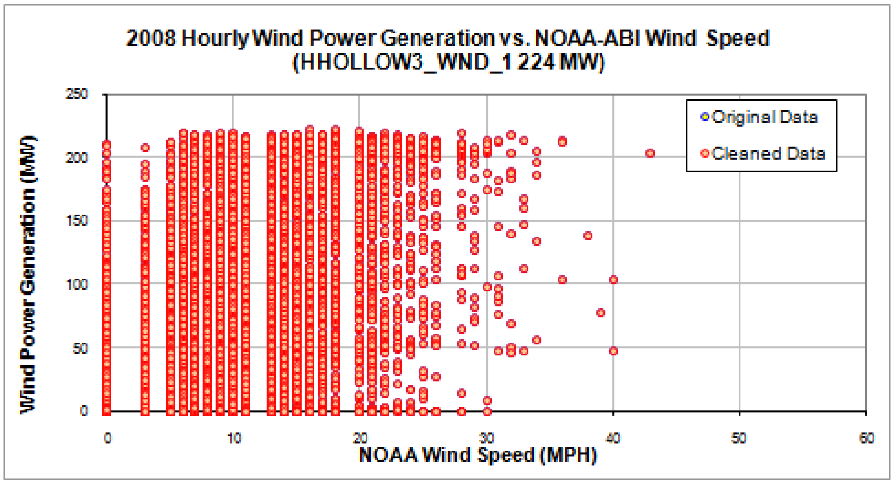

Figure 11-73: HHOLLOW3_WND_3 – Hourly Wind Power vs. NOAA Wind Speed (2008)

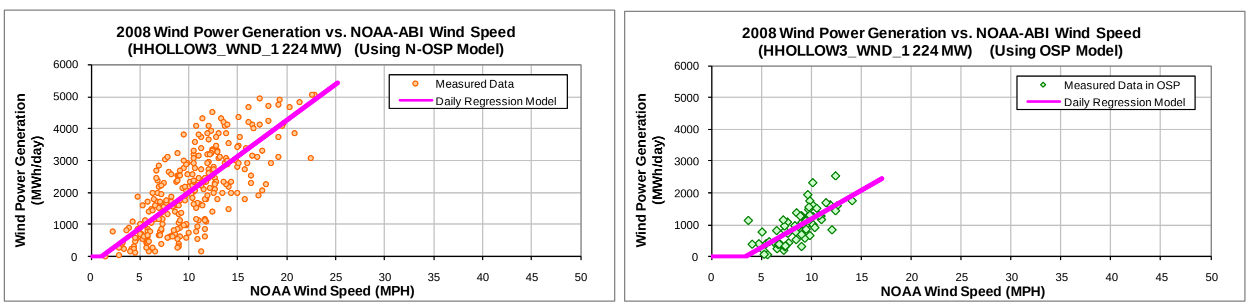

Figure 11-74: HHOLLOW3_WND_3 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-74: HHOLLOW3_WND_3 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-223.8046
Left Slope (MWh/mph-day)	224.2329
RMSE (MWh/day)	812.8833
R2	0.5646
CV-RMSE	38.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-588.4524
Left Slope (MWh/mph-day)	176.9694
RMSE (MWh/day)	396.8489
R2	0.5083
CV-RMSE	42.1%

Table 11-75: HHOLLOW3_WND_3 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	8.84	53,891	51,007	5.35%	35%	33%
Feb-08	28	10.60	67,188	60,256	10.32%	45%	40%
Mar-08	30	12.39	82,128	76,600	6.73%	51%	48%
Apr-08	30	11.95	76,612	73,698	3.80%	48%	46%
May-08	30	12.67	76,998	78,532	-1.99%	48%	49%
Jun-08	29	13.81	76,246	83,287	-9.23%	49%	54%
Jul-08	28	10.71	40,494	46,542	-14.94%	27%	31%
Aug-08	31	8.09	21,215	26,133	-23.18%	13%	16%
Sep-08	30	6.71	24,905	27,309	-9.66%	15%	17%
Oct-08	26	7.47	39,338	37,729	4.09%	28%	27%
Nov-08	28	7.81	41,468	42,747	-3.09%	28%	28%
Dec-08	28	9.30	55,534	52,122	6.14%	37%	35%
Total	347	10.05	656,017	655,962	0.01%	35%	35%
Total in OSP (07/15-09/15)	63	8.65	59,395	59,389	0.01%	18%	18%

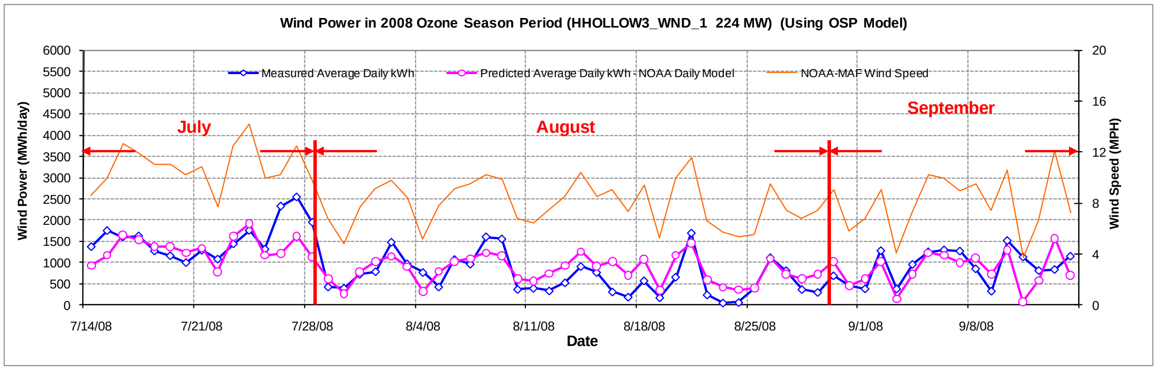

Figure 11-75: HHOLLOW3_WND_3 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

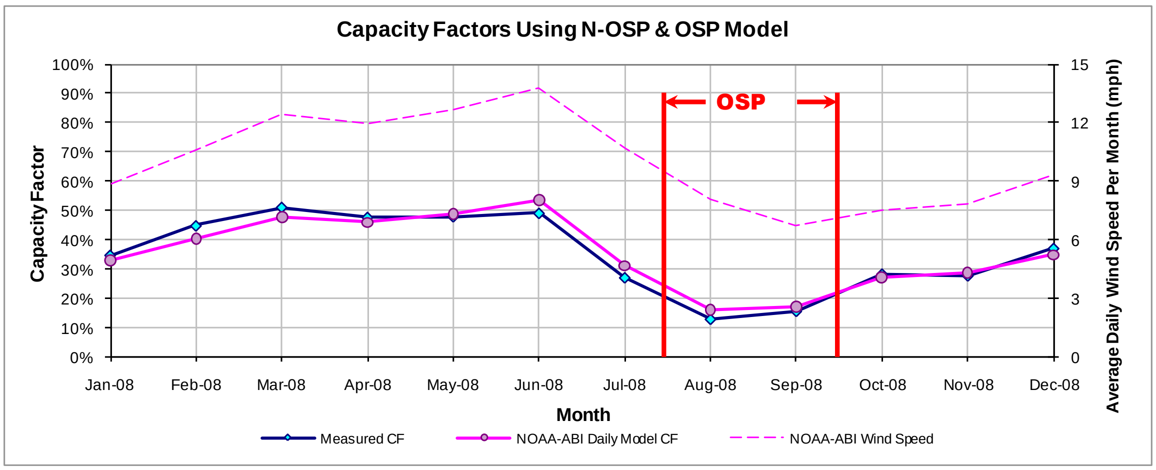

Figure 11-76: HHOLLOW3_WND_3 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-76: HHOLLOW3_WND_3 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
790,626	691,937	691,879

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
1,130	943	943

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.19 Horse Hollow Phase 4

Table 11-77: Site Information for Horse Hollow Phase 4

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
HOLLOW4_WND	WIND	Abilene	Taylor	May-06	115	FPL Energy	Horse Hollow Phase 4	Mitsubishi 1000 (160)	ERCOT	AEP-West	AEP/ TNC	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
HOLLOW4_WND	HOLLOW4_WND	112

11.19.1 Horse Hollow Phase 4 – HHOLLOW4_WND_1

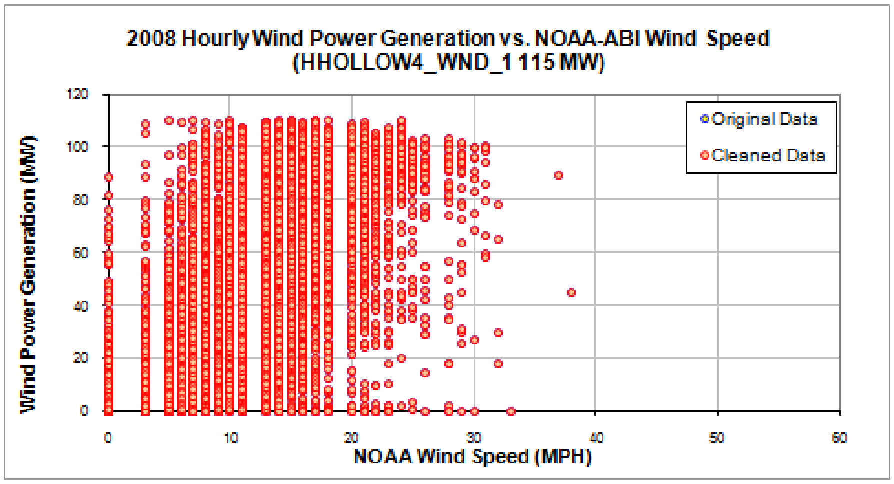

Figure 11-77: HHOLLOW4_WND_1 – Hourly Wind Power vs. NOAA Wind Speed (2008)

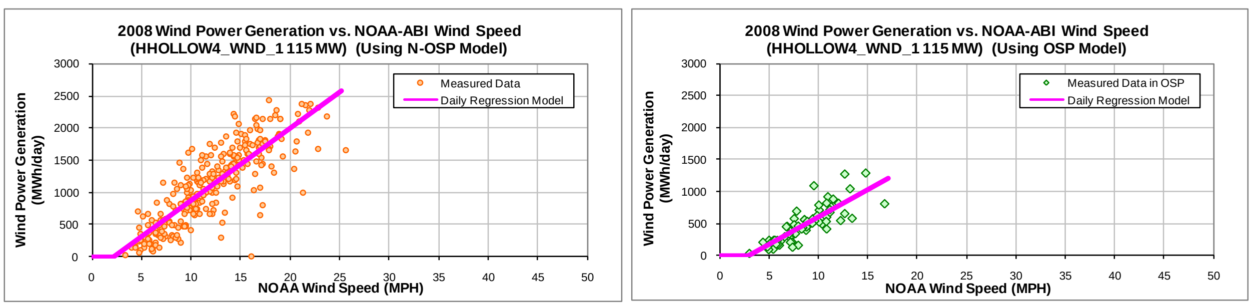

Figure 11-78: HHOLLOW4_WND_1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-78: HHOLLOW4_WND_1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-240.6521
Left Slope (MWh/mph-day)	111.9995
RMSE (MWh/day)	320.9372
R2	0.7034
CV-RMSE	29.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-251.9012
Left Slope (MWh/mph-day)	85.4489
RMSE (MWh/day)	162.7676
R2	0.6782
CV-RMSE	33.1%

Table 11-79: HHOLLOW4_WND_1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	30,262	34,287	-13.30%	37%	41%
Feb-08	28	12.53	33,293	32,569	2.17%	43%	42%
Mar-08	31	13.35	38,246	38,879	-1.65%	45%	45%
Apr-08	30	13.87	37,488	39,371	-5.02%	45%	48%
May-08	31	12.79	37,996	36,938	2.78%	44%	43%
Jun-08	30	13.70	37,700	38,808	-2.94%	46%	47%
Jul-08	31	10.58	21,806	24,265	-11.28%	25%	28%
Aug-08	31	7.43	11,328	11,878	-4.85%	13%	14%
Sep-08	30	7.95	14,037	15,674	-11.66%	17%	19%
Oct-08	30	10.26	27,270	27,253	0.06%	33%	33%
Nov-08	30	10.24	32,215	27,182	15.62%	39%	33%
Dec-08	31	12.20	40,394	34,899	13.60%	47%	41%
Total	363	11.43	362,035	362,003	0.01%	36%	36%
Total in OSP (07/15-09/15)	63	8.71	31,018	31,014	0.01%	18%	18%

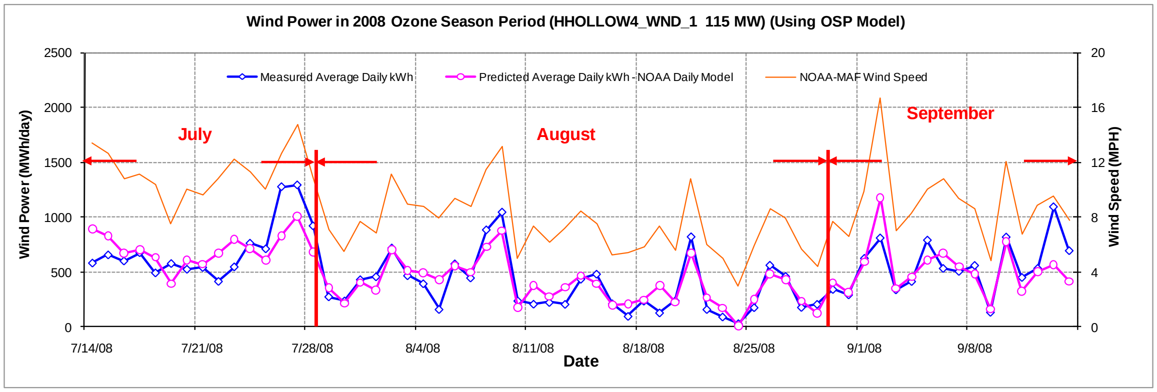

Figure 11-79: HHOLLOW4_WND_1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

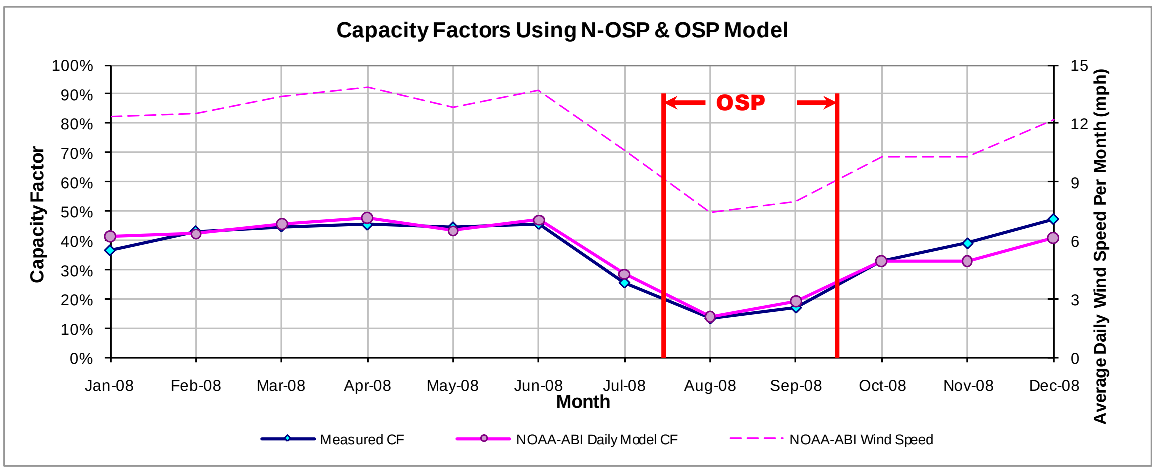

Figure 11-80: HHOLLOW4_WND_1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-80: HHOLLOW4_WND_1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
356,830	365,027	364,994

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
578	492	496

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

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11.20 Desert Sky

Table 11-81: Site Information for Desert Sky

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
INDNENR	WIND	Iraan	PECOS	Dec-01	160	AEP	Desert Sky (Indian Mesa II)	Enron 1500 (107)	ERCOT	TXU	WTU	FST	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
INDNENR_INDNENR	INDNENR	
INDNENR_INDNENR_2	INDNENR	

11.20.1 Desert Sky – INDNENR_INDNENR

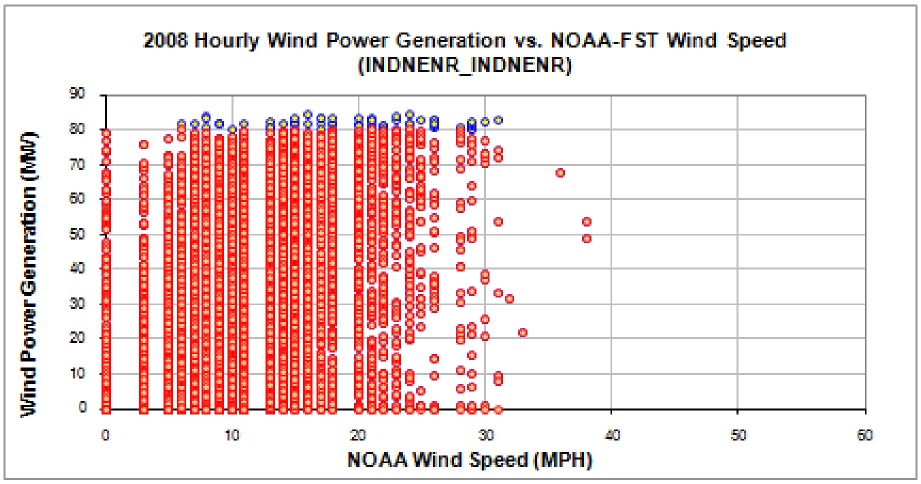


Figure 11-81: INDNENR_INDNENR – Hourly Wind Power vs. NOAA Wind Speed (2008)

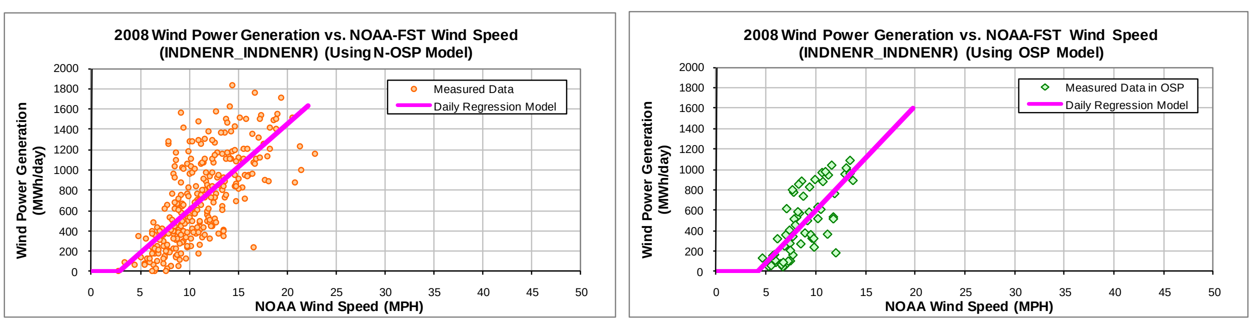


Figure 11-82: INDNENR_INDNENR – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-82: INDNENR_INDNENR – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-235.7761
Left Slope (MWh/mph-day)	84.5402
RMSE (MWh/day)	306.7118
R2	0.4871
CV-RMSE	43.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-418.4257
Left Slope (MWh/mph-day)	102.1051
RMSE (MWh/day)	221.7736
R2	0.5291
CV-RMSE	45.9%

Table 11-83: INDNENR_INDNENR – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	9.99	20,579	17,669	14.14%	37%	32%
Feb-08	29	10.93	19,913	19,970	-0.29%	36%	36%
Mar-08	31	12.09	19,807	24,367	-23.02%	33%	41%
Apr-08	27	11.21	16,813	19,229	-14.36%	32%	37%
May-08	29	12.23	21,399	23,139	-8.13%	38%	42%
Jun-08	30	13.46	27,853	27,074	2.80%	48%	47%
Jul-08	31	11.33	25,280	22,260	11.95%	42%	37%
Aug-08	29	8.58	11,543	13,272	-14.98%	21%	24%
Sep-08	30	8.11	9,417	12,864	-36.60%	16%	22%
Oct-08	30	10.65	22,311	19,927	10.69%	39%	35%
Nov-08	30	9.17	18,746	16,192	13.62%	33%	28%
Dec-08	29	10.30	20,732	18,412	11.19%	37%	33%
Total	354	10.68	234,394	234,375	0.01%	34%	34%
Total in OSP (07/15-09/15)	61	8.83	29,474	29,467	0.02%	25%	25%

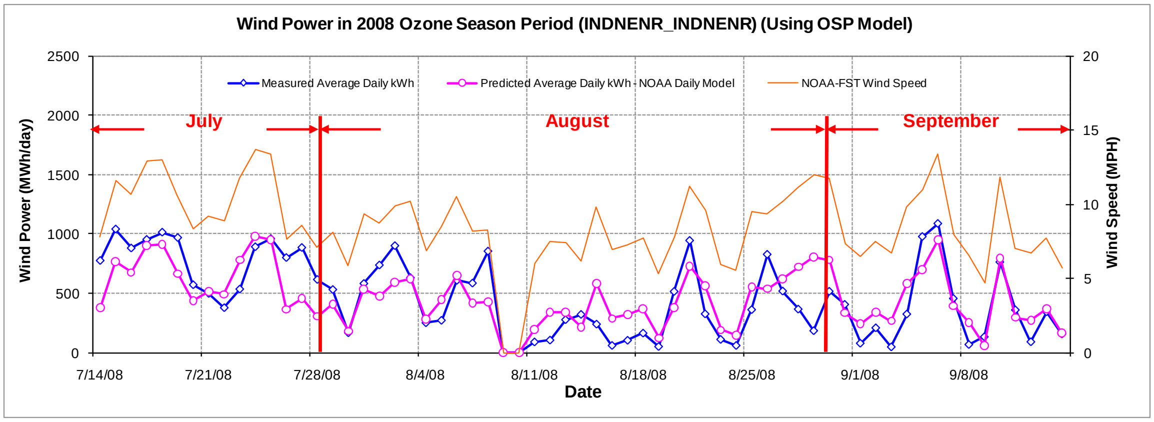


Figure 11-83: INDNENR_INDNENR – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

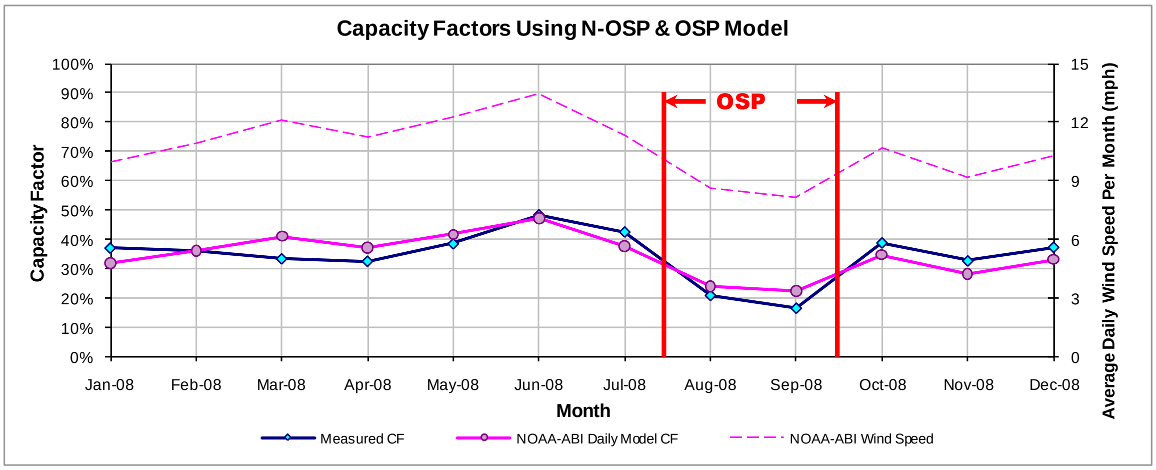


Figure 11-84: INDNENR_INDNENR – Predicted Capacity Factors Using Daily Models (2008)

Table 11-84: INDNENR_INDNENR – Predicted Power Production in 1999

Annual				OSD		
1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)		1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
258,590	242,340	242,320		598	483	483

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.20.2 Desert Sky – INDNENR_INDNENR2

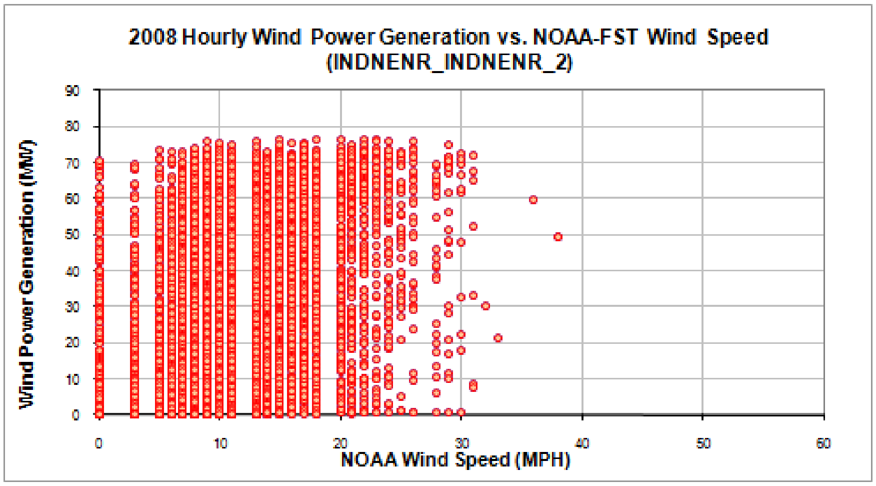


Figure 11-85: INDNENR_INDNENR2 – Hourly Wind Power vs. NOAA Wind Speed (2008)

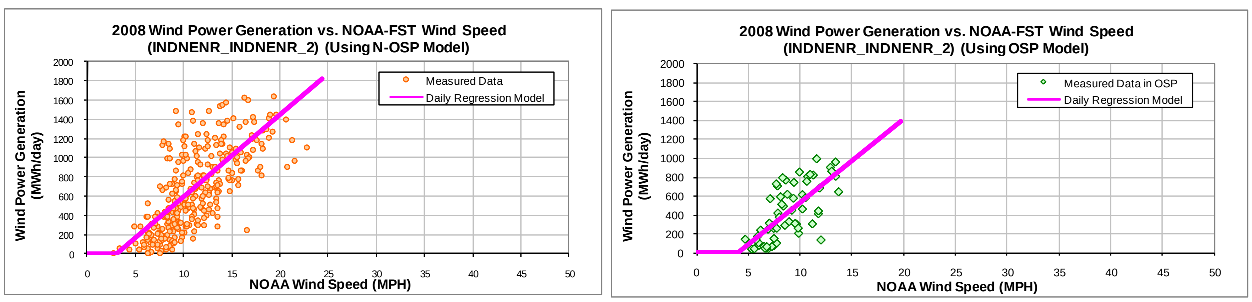


Figure 11-86: INDNENR_INDNENR2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-85: INDNENR_INDNENR2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-242.6424
Left Slope (MWh/mph-day)	80.505
RMSE (MWh/day)	298.3527
R2	0.4887
CV-RMSE	45.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-355.555
Left Slope (MWh/mph-day)	88.5629
RMSE (MWh/day)	210.2159
R2	0.4847
CV-RMSE	49.3%

Table 11-86: INDNENR_INDNENR2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	9.99	18,706	16,318	12.77%	34%	29%
Feb-08	29	10.93	18,749	18,491	1.38%	34%	33%
Mar-08	31	12.09	18,822	22,642	-20.30%	32%	38%
Apr-08	30	11.86	19,807	21,364	-7.86%	34%	37%
May-08	31	12.64	20,715	24,023	-15.97%	35%	40%
Jun-08	30	13.46	26,209	25,238	3.71%	46%	44%
Jul-08	31	11.33	22,639	20,206	10.75%	38%	34%
Aug-08	29	8.58	10,325	11,726	-13.57%	19%	21%
Sep-08	30	8.11	8,341	11,577	-38.80%	14%	20%
Oct-08	30	10.65	21,092	18,432	12.61%	37%	32%
Nov-08	30	9.17	17,691	14,876	15.91%	31%	26%
Dec-08	29	10.30	18,803	17,007	9.55%	34%	31%
Total	359	10.78	221,900	221,901	0.00%	32%	32%
Total in OSP (07/15-09/15)	61	8.83	26,015	26,008	0.02%	22%	22%

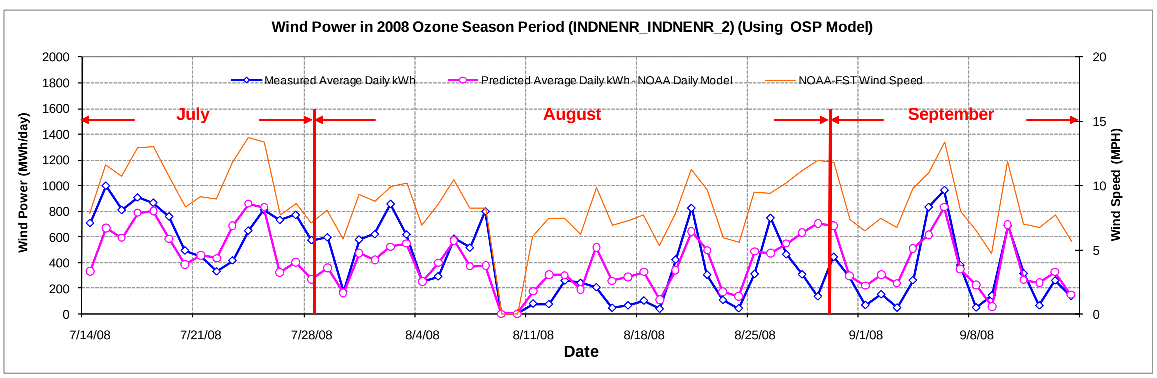


Figure 11-87: INDNENR_INDNENR2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

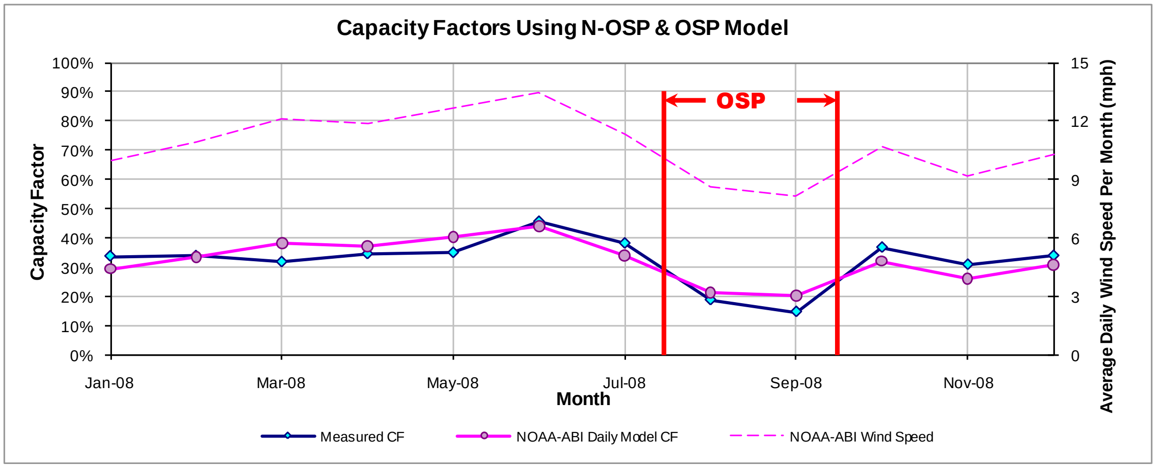


Figure 11-88: INDNENR_INDNENR2 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-87: INDNENR_INDNENR2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
238,048	226,227	226,227

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
526	426	426

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.21 Indian Mesa

Table 11-88: Site Information for Indian Mesa

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
INDNNWP	WIND	Iraan	PECOS	Jun-01	82.5	Orion Energy/American National Wind Power	Indian Mesa I	Vestas V-47 (125)	ERCOT	AEP-West	WTU	FST	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
INDNNWP_INDNNWP	INDNNWP	82.5

11.21.1 Indian Mesa – INDNNWP_INDNNWP

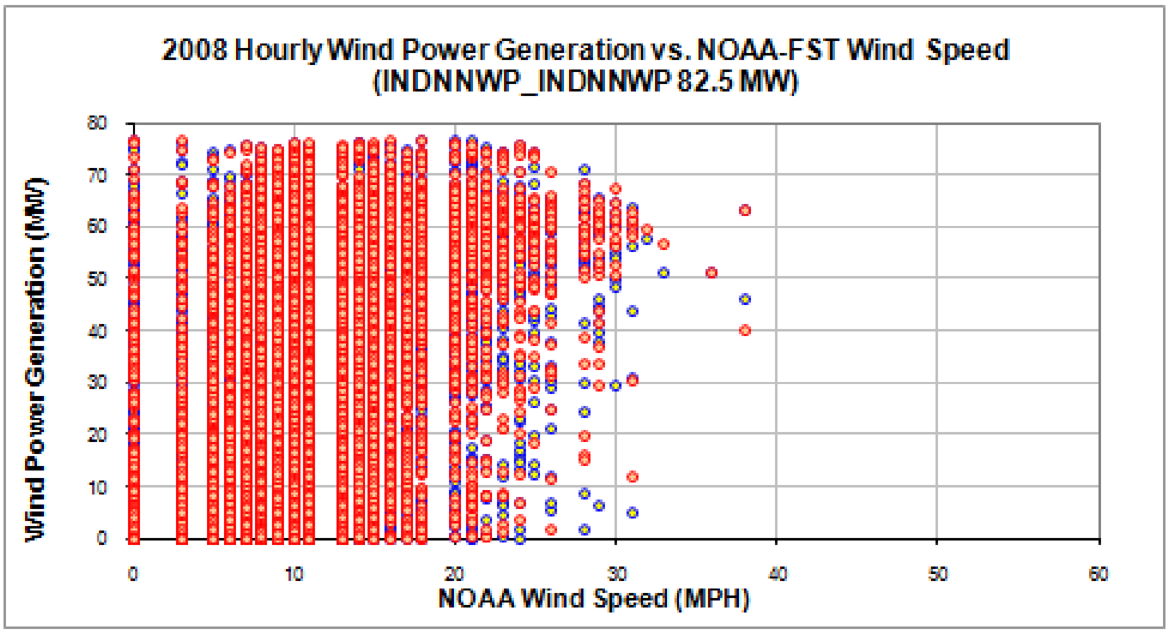


Figure 11-89: INDNNWP_INDNNWP – Hourly Wind Power vs. NOAA Wind Speed (2008)

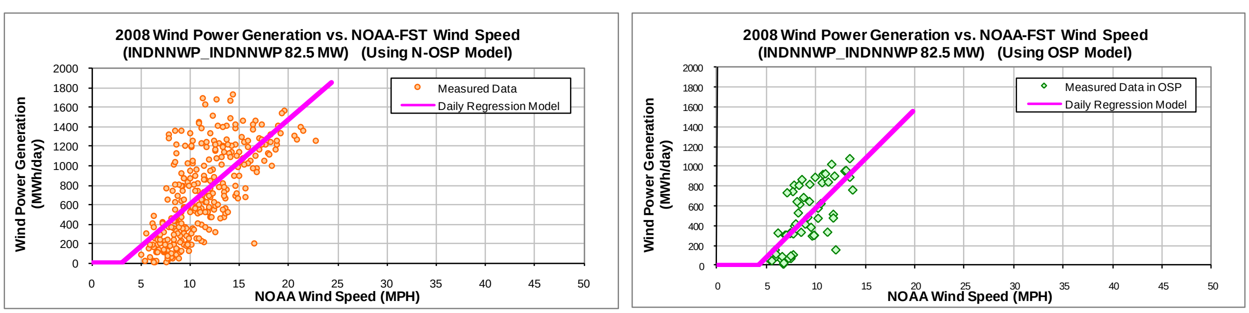


Figure 11-90: INDNNWP_INDNNWP – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-89: INDNNWP_INDNNWP – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-273.2288
Left Slope (MWh/mph-day)	87.6157
RMSE (MWh/day)	326.355
R2	0.4741
CV-RMSE	45.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-418.5264
Left Slope (MWh/mph-day)	99.5997
RMSE (MWh/day)	228.3984
R2	0.4918
CV-RMSE	48.8%

Table 11-90: INDNNWP_INDNNWP – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	10.70	19,167	19,256	-0.47%	33%	34%
Feb-08	28	11.15	20,573	19,709	4.20%	37%	36%
Mar-08	31	12.09	22,981	24,358	-6.00%	37%	40%
Apr-08	30	11.86	22,131	22,976	-3.82%	37%	39%
May-08	31	12.64	23,168	25,861	-11.62%	38%	42%
Jun-08	30	13.46	26,368	27,193	-3.13%	44%	46%
Jul-08	31	11.33	24,045	21,870	9.04%	39%	36%
Aug-08	29	8.58	10,961	12,646	-15.37%	19%	22%
Sep-08	29	8.23	9,036	12,330	-36.45%	16%	21%
Oct-08	29	10.90	21,265	19,767	7.05%	37%	34%
Nov-08	30	9.17	18,743	15,915	15.09%	32%	27%
Dec-08	29	10.30	21,708	18,244	15.96%	38%	32%
Total	356	10.89	240,147	240,125	0.01%	34%	34%
Total in OSP (07/15-09/15)	60	8.90	28,072	28,065	0.02%	24%	24%

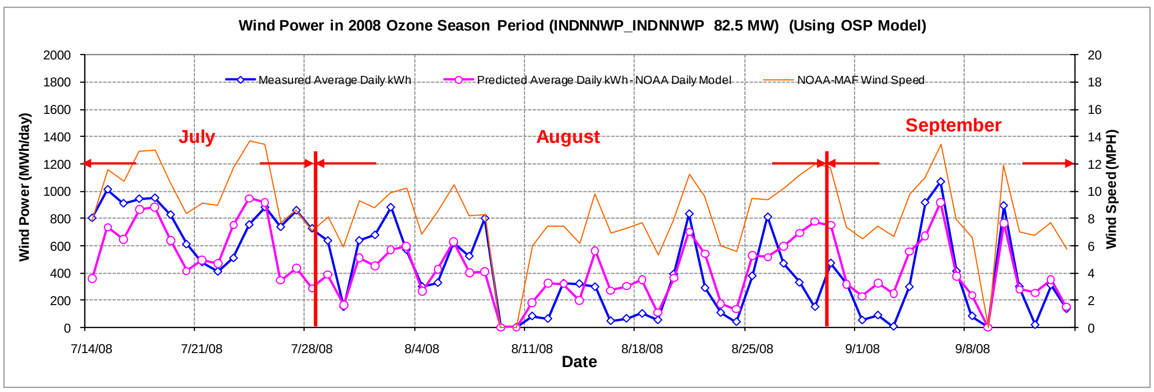


Figure 11-91: INDNNWP_INDNNWP – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

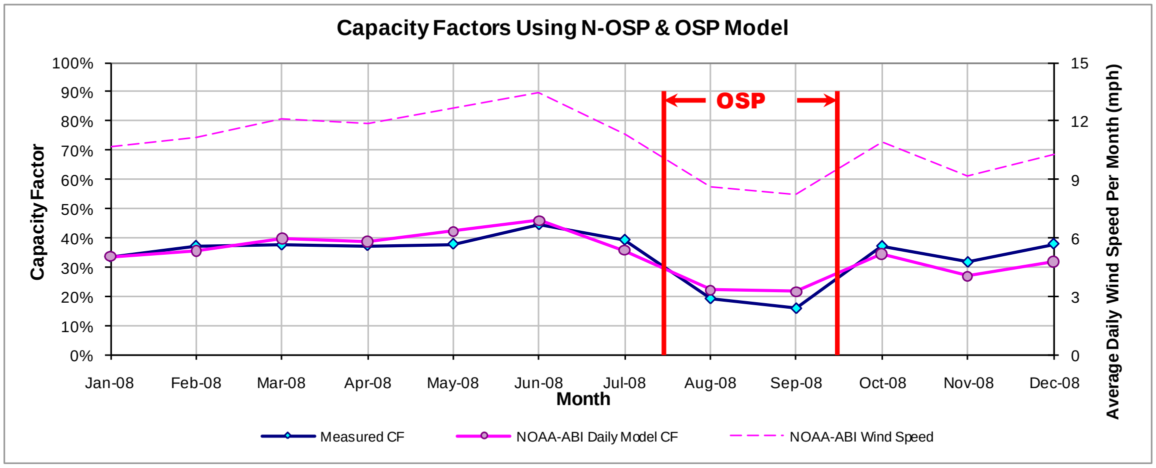


Figure 11-92: INDNNWP_INDNNWP – Predicted Capacity Factors Using Daily Models (2008)

Table 11-91: INDNNWP_INDNNWP – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
256,350	246,893	246,870

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
573	468	468

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.22 King Mountain Wind Ranch (King_NE_KINGNE)

Table 11-92: Site Information for King_NE_KINGNE

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
KING_NE	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_NE_KINGNE	KING_NE	79.3

11.22.1 King Mountain Wind Ranch – King_NE_KINGNE

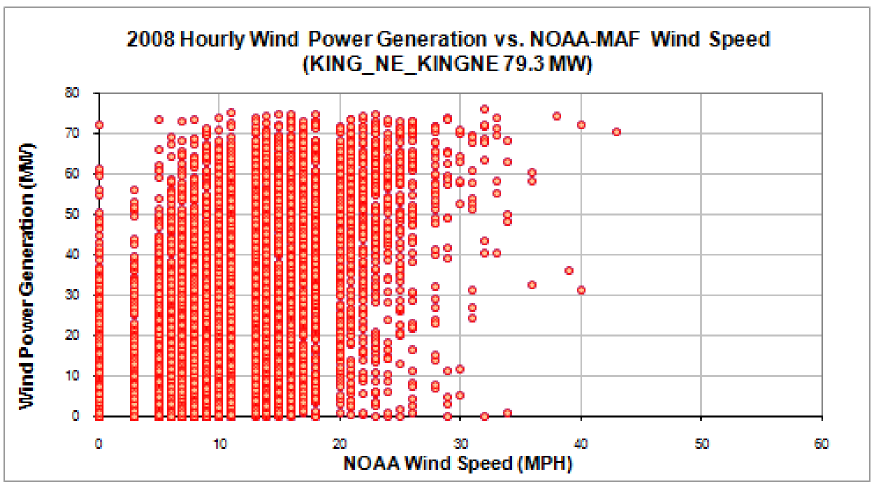


Figure 11-93: King_NE_KINGNE - Hourly Wind Power vs. NOAA Wind Speed (2008)

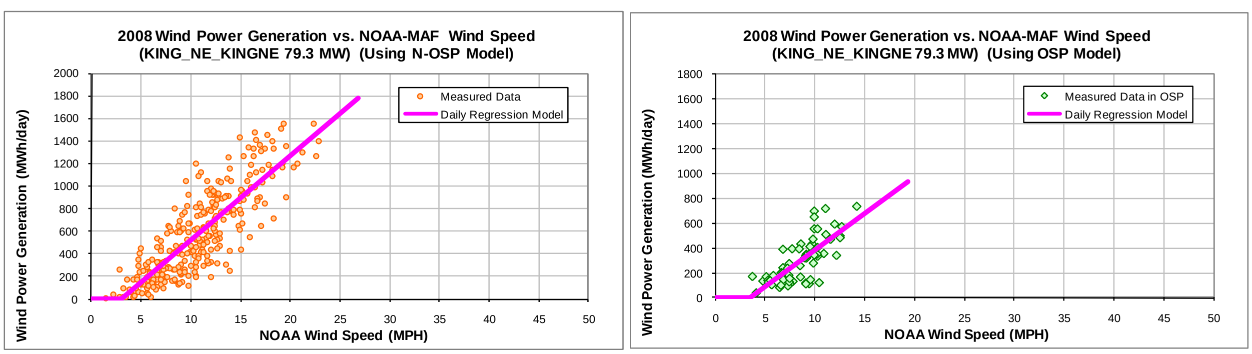


Figure 11-94: King_NE_KINGNE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-93: King_NE_KINGNE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-229.6078
Left Slope (MWh/mph-day)	75.0759
RMSE (MWh/day)	205.1573
R2	0.7069
CV-RMSE	35.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-204.7012
Left Slope (MWh/mph-day)	58.8746
RMSE (MWh/day)	124.8855
R2	0.5371
CV-RMSE	41.2%

Table 11-94: King_NE_KINGNE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	9.30	16,241	14,526	10.56%	28%	25%
Feb-08	29	10.75	16,986	16,746	1.41%	31%	30%
Mar-08	30	12.39	20,897	21,006	-0.53%	37%	37%
Apr-08	30	11.95	18,981	20,035	-5.55%	33%	35%
May-08	31	12.81	22,118	22,703	-2.64%	37%	38%
Jun-08	30	13.89	22,624	24,406	-7.88%	40%	43%
Jul-08	31	11.22	16,597	16,578	0.11%	28%	28%
Aug-08	31	8.09	7,473	8,417	-12.64%	13%	14%
Sep-08	29	6.58	5,531	6,257	-13.11%	10%	11%
Oct-08	31	9.02	15,782	14,019	11.17%	27%	24%
Nov-08	30	8.29	11,950	11,857	0.78%	21%	21%
Dec-08	31	9.94	17,191	16,019	6.82%	29%	27%
Total	364	10.36	192,370	192,569	-0.10%	28%	28%
Total in OSP (07/15-09/15)	62	8.62	18,777	18,775	0.01%	16%	16%

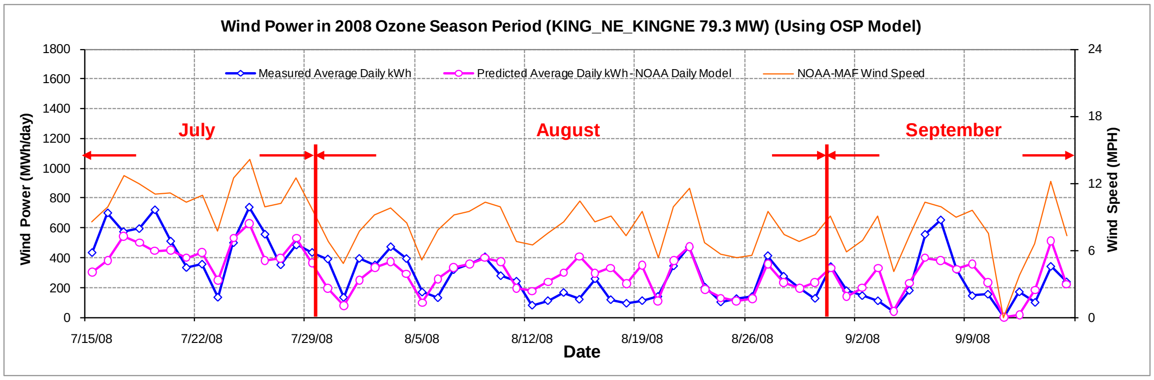


Figure 11-95: King_NE_KINGNE – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

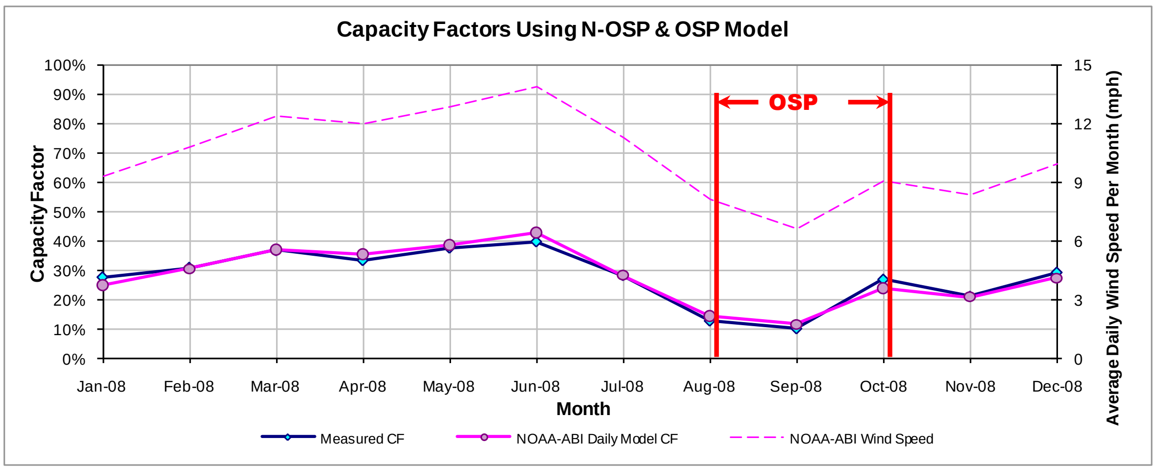


Figure 11-96: King_NE_KINGNE – Predicted Capacity Factors Using Daily Models (2008)

Table 11-95: King_NE_KINGNE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
206,953	193,427	193,627

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
353	303	303

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.23 King Mountain Wind Ranch (KING_NW_KINGNW)

Table 11-96: Site Information for KING_NW_KINGNW

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
KING_NW	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_NW_KINGNW	KING_NW	79.3

11.23.1 King Mountain Wind Ranch – KING_NW_KINGNW

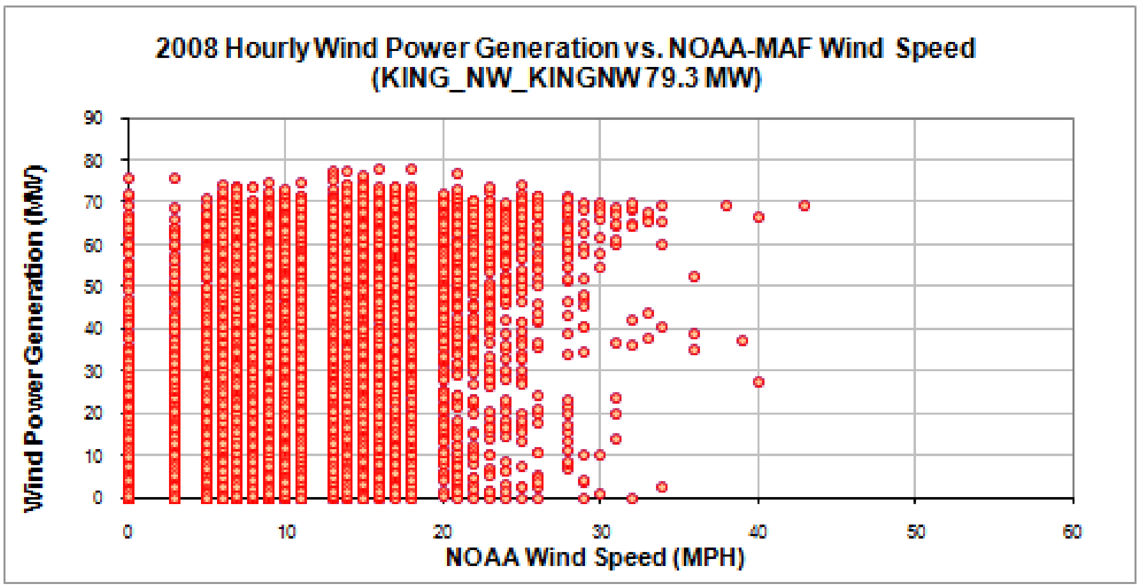


Figure 11-97: KING_NW_KINGNW – Hourly Wind Power vs. NOAA Wind Speed (2008)

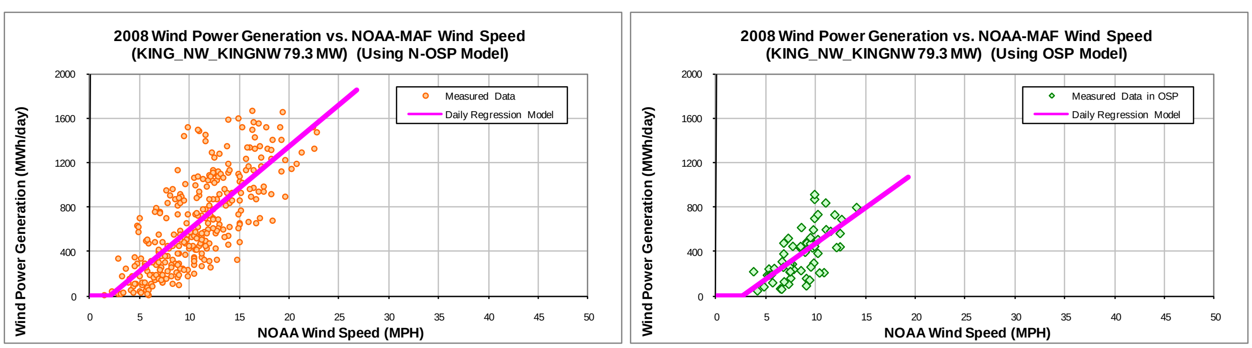


Figure 11-98: KING_NW_KINGNW – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-97: KING_NW_KINGNW – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-148.6328
Left Slope (MWh/mph-day)	74.8437
RMSE (MWh/day)	281.1522
R2	0.5607
CV-RMSE	43%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-174.0161
Left Slope (MWh/mph-day)	64.2765
RMSE (MWh/day)	163.9429
R2	0.4452
CV-RMSE	43.1%

Table 11-98: KING_NW_KINGNW – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	9.30	19,616	16,969	13.49%	33%	29%
Feb-08	29	10.75	19,820	19,022	4.03%	36%	34%
Mar-08	30	12.39	21,278	23,349	-9.73%	37%	41%
Apr-08	30	11.95	21,164	22,381	-5.75%	37%	39%
May-08	31	12.81	23,525	25,121	-6.78%	40%	43%
Jun-08	30	13.89	25,425	26,738	-5.16%	45%	47%
Jul-08	31	11.22	19,504	19,136	1.88%	33%	32%
Aug-08	31	8.09	9,839	10,723	-8.99%	17%	18%
Sep-08	29	6.58	7,677	8,458	-10.17%	14%	15%
Oct-08	31	9.02	18,657	16,366	12.28%	32%	28%
Nov-08	30	8.29	14,095	14,165	-0.50%	25%	25%
Dec-08	31	9.94	20,264	18,458	8.91%	34%	31%
Total	364	10.36	220,863	220,886	-0.01%	32%	32%
Total in OSP (07/15-09/15)	62	8.62	23,567	23,564	0.01%	20%	20%

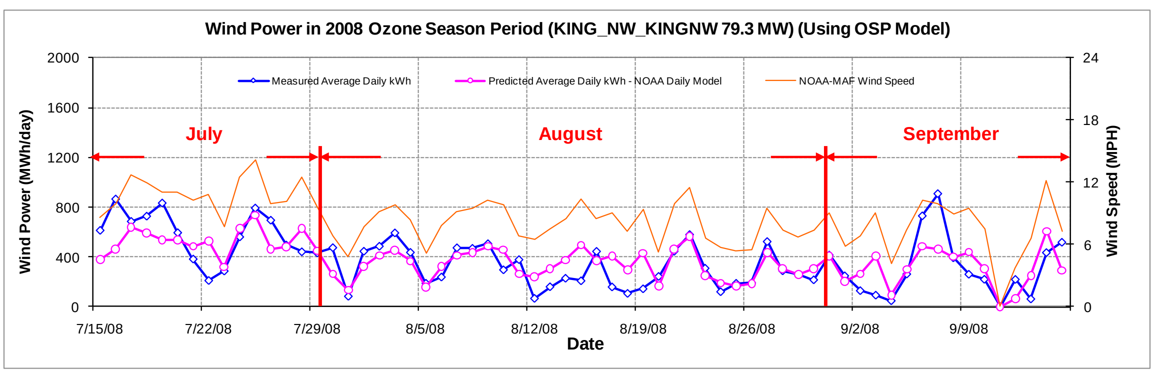


Figure 11-99: KING_NW_KINGNW – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

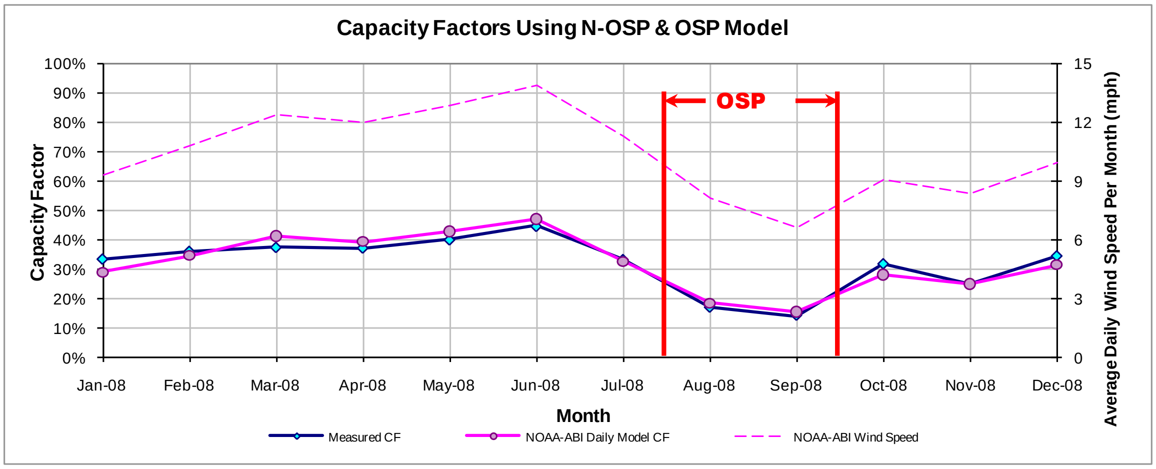


Figure 11-100: KING_NW_KINGNW – Predicted Capacity Factors Using Daily Models (2008)

Table 11-99: KING_NW_KINGNW – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008Daily Model)
235,699	222,076	222,100

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
435	380	380

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.24 King Mountain Wind Ranch (KING_SE_KINGSE)

Table 11-100: Site Information for KING_SE_KINGSE

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
KING_SE	WIND	McCamey	UPTON	Dec-01	40.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_SE_KINGSE	KING_SE	40.3

11.24.1 King Mountain Wind Ranch – KING_SE_KINGSE

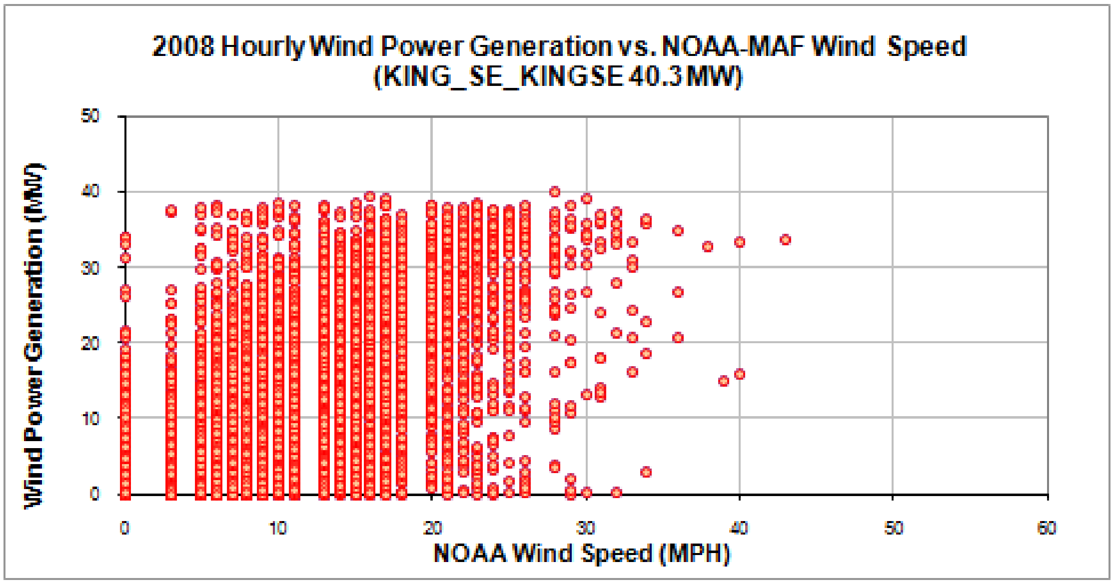


Figure 11-101: KING_SE_KINGSE – Hourly Wind Power vs. NOAA Wind Speed (2008)

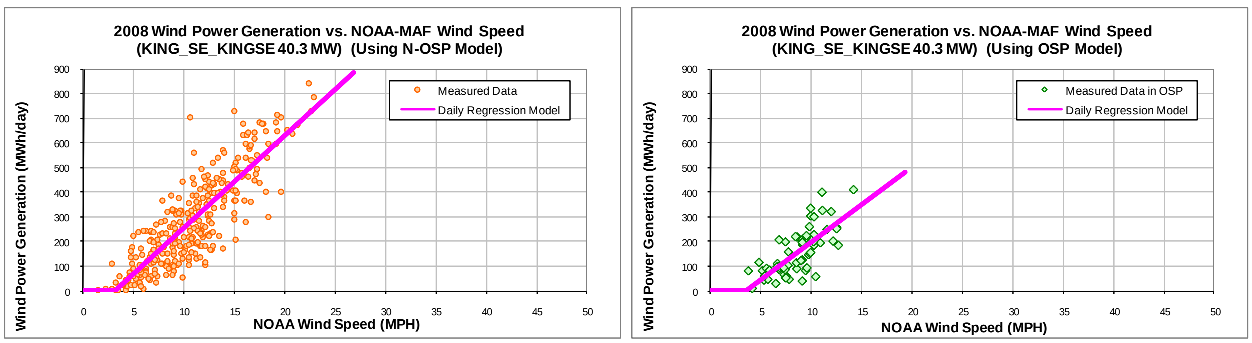


Figure 11-102: KING_SE_KINGSE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-101: KING_SE_KINGSE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-117.1527
Left Slope (MWh/mph-day)	37.2969
RMSE (MWh/day)	98.3192
R2	0.7216
CV-RMSE	34.8%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-105.8624
Left Slope (MWh/mph-day)	30.4033
RMSE (MWh/day)	65.243
R2	0.5314
CV-RMSE	41.8%

Table 11-102: KING_SE_KINGSE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	9.30	7,828	7,121	9.03%	26%	24%
Feb-08	29	10.75	8,139	8,230	-1.11%	29%	29%
Mar-08	30	12.39	10,145	10,343	-1.95%	35%	36%
Apr-08	30	11.95	8,910	9,860	-10.67%	31%	34%
May-08	31	12.81	10,787	11,183	-3.67%	36%	37%
Jun-08	30	13.89	11,672	12,032	-3.09%	40%	41%
Jul-08	31	11.22	8,790	8,323	5.31%	29%	28%
Aug-08	31	8.09	3,894	4,342	-11.50%	13%	14%
Sep-08	29	6.58	2,812	3,133	-11.40%	10%	11%
Oct-08	31	9.02	7,126	6,875	3.52%	24%	23%
Nov-08	30	8.29	6,526	5,801	11.11%	22%	20%
Dec-08	31	9.94	8,365	7,863	6.01%	28%	26%
Total	364	10.36	94,994	95,105	-0.12%	27%	27%
Total in OSP (07/15-09/15)	62	8.62	9,687	9,686	0.01%	16%	16%

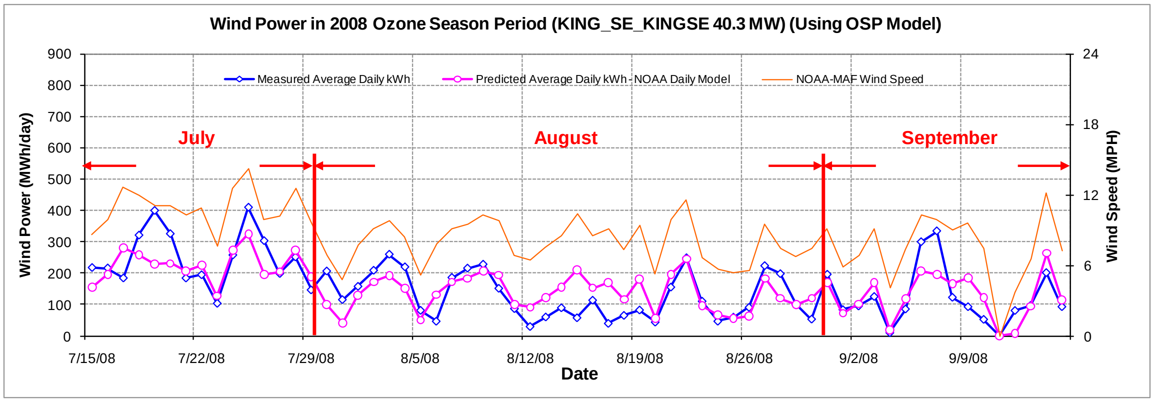


Figure 11-103: KING_SE_KINGSE – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

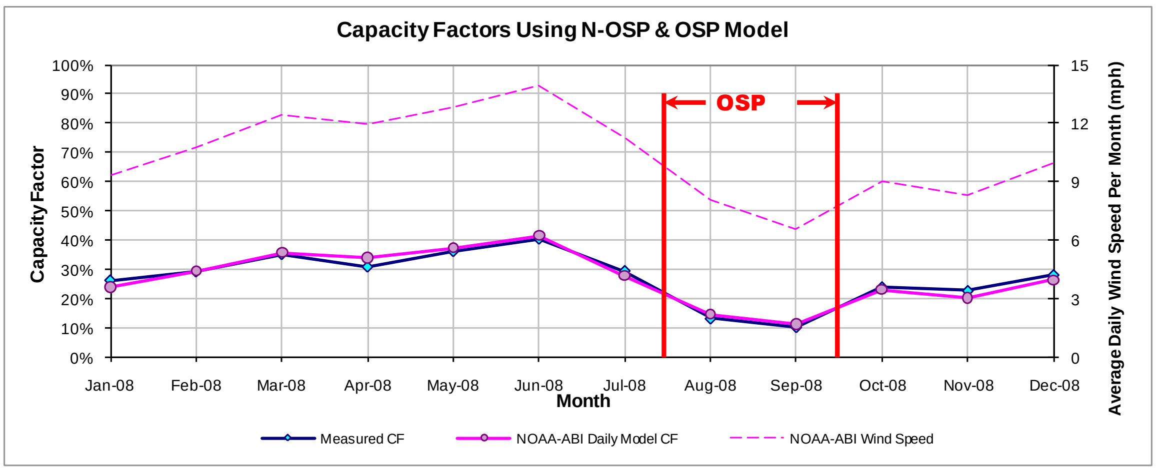


Figure 11-104: KING_SE_KINGSE – Predicted Capacity Factors Using Daily Models (2008)

Table 11-103: KING_SE_KINGSE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
102,313	95,516	95,628

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
182	156	156

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.25 King Mountain Wind Ranch (KING_SW_KINGSW)

Table 11-104: Site Information for KING_SW_KINGSW

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
KING_SW	WIND	McCamey	UPTON	Dec-01	79.3	FPL/Cielo	King Mountain Wind Ranch	Bonus 1300 (61)	ERCOT	AEP-West	WTU	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KING_SW_KINGSW	KING_SW	79.3

11.25.1 King Mountain Wind Ranch – KING_SW_KINGSW

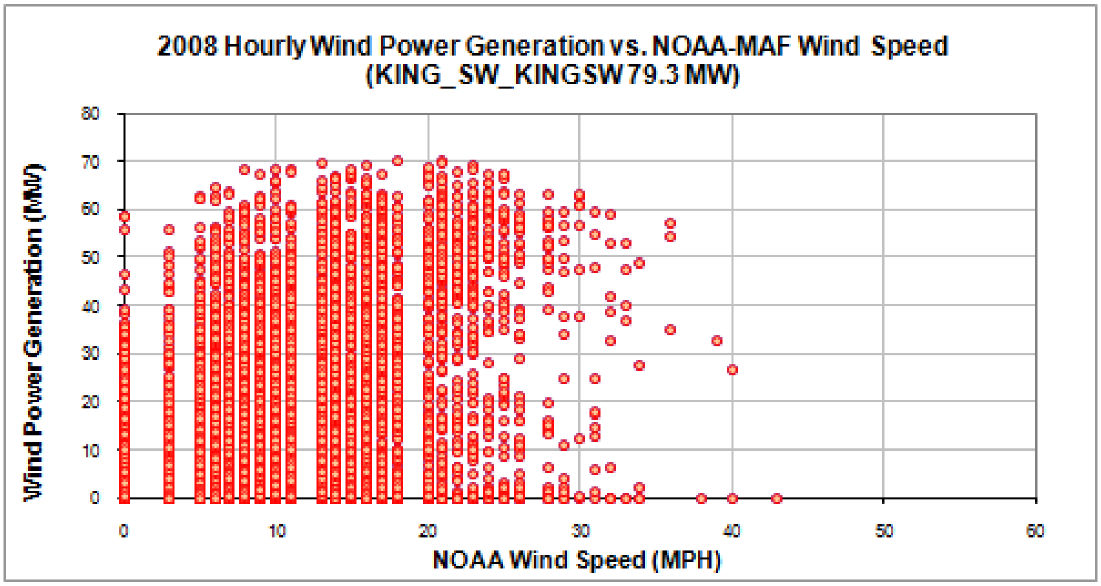
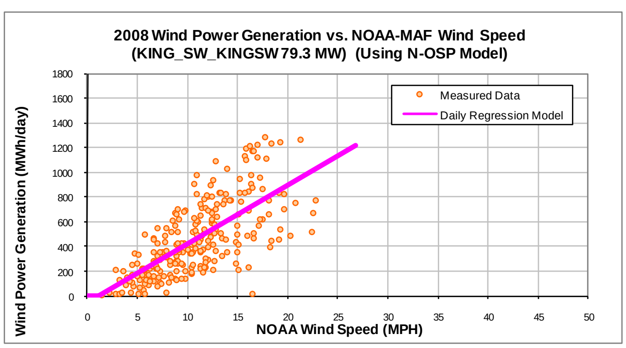


Figure 11-105: KING_SW_KINGSW - Hourly Wind Power vs. NOAA Wind Speed (2008)



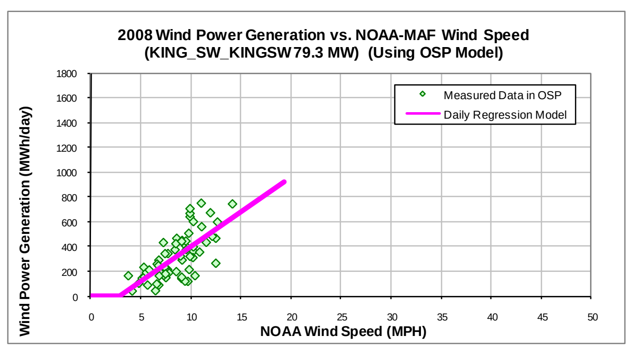


Figure 11-106: KING_SW_KINGSW – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-105: KING_SW_KINGSW – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-55.6722
Left Slope (MWh/mph-day)	47.3657
RMSE (MWh/day)	215.9848
R2	0.4809
CV-RMSE	46.8%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-166.3484
Left Slope (MWh/mph-day)	56.5692
RMSE (MWh/day)	135.1685
R2	0.4777
CV-RMSE	42.1%

Table 11-106: KING_SW_KINGSW – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08	7	11.88	3,445	3,550	-3.03%	26%	27%
Mar-08	30	12.39	14,074	15,929	-13.18%	25%	28%
Apr-08	30	11.95	13,805	15,316	-10.95%	24%	27%
May-08	31	12.81	17,242	17,088	0.89%	29%	29%
Jun-08	30	13.89	19,393	18,073	6.80%	34%	32%
Jul-08	31	11.22	16,686	14,467	13.30%	28%	25%
Aug-08	31	8.09	8,382	9,028	-7.70%	14%	15%
Sep-08	29	6.58	6,836	6,875	-0.56%	12%	12%
Oct-08	31	9.02	11,998	11,521	3.98%	20%	20%
Nov-08	30	8.29	9,309	10,116	-8.67%	16%	18%
Dec-08	31	9.94	13,673	12,872	5.86%	23%	22%
Total	311	10.46	134,844	134,834	0.01%	23%	23%
Total in OSP (07/15-09/15)	62	8.62	19,923	19,921	0.01%	17%	17%

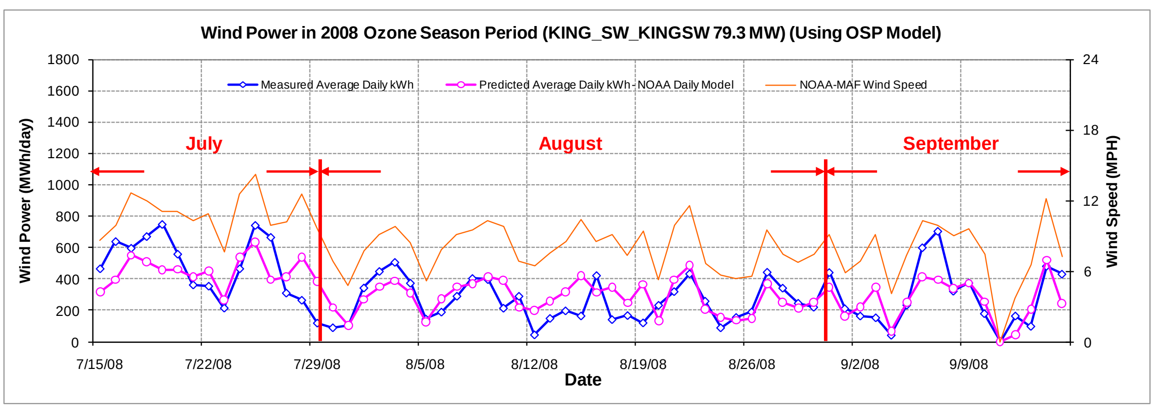


Figure 11-107: KING_SW_KINGSW – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

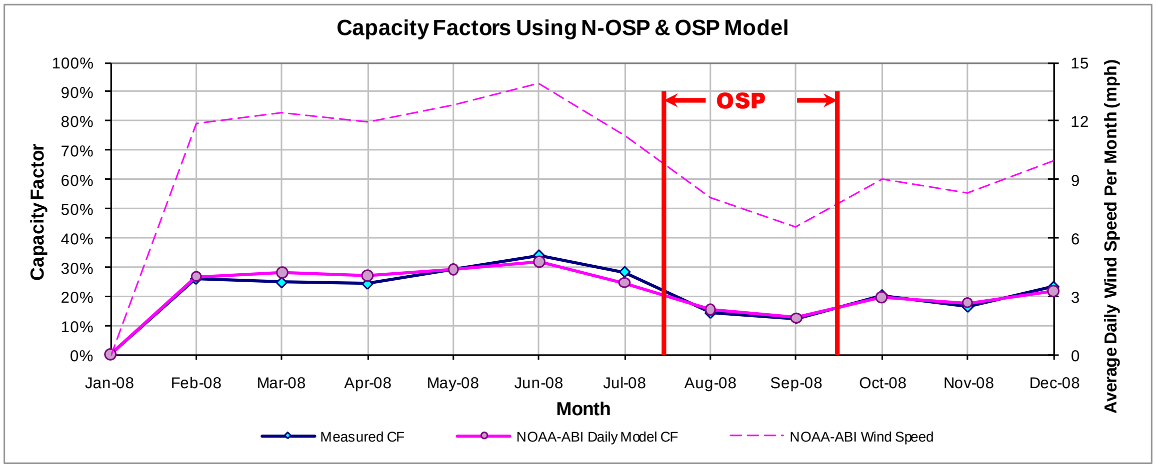


Figure 11-108: KING_SW_KINGSW – Predicted Capacity Factors Using Daily Models (2008)

Table 11-107: KING_SW_KINGSW – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
166,700	158,691	158,679

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
369	321	321

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.26 Texas Wind Power Project

Table 11-108: Site Information for Texas Wind Power Project

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
KUNITZ	WIND		CULBERSON	Jan-95	35	LG&E	Texas Wind Power Project	Kenetech (112)	ERCOT	Colorado River Authority		GDP	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
KUNITZ_WIND_LGE_J01	KUNITZ	24.9
KUNITZ_WIND_LGE_J02	KUNITZ	10.1

11.26.1 Texas Wind Power Project – KUNITZ_WIND_LGE

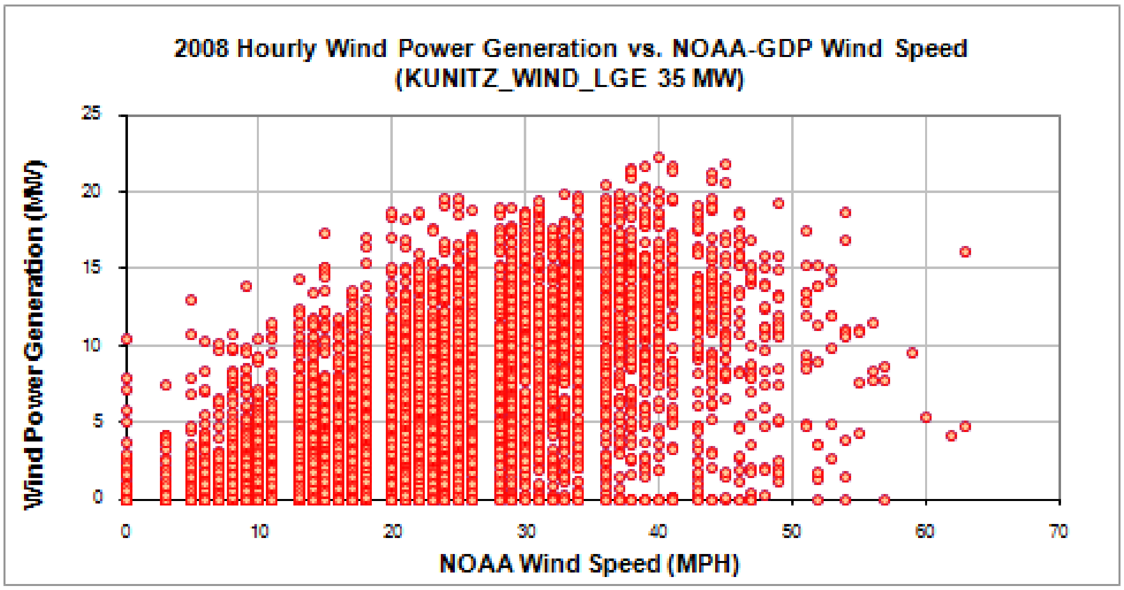


Figure 11-109: KUNITZ_WIND_LGE – Hourly Wind Power vs. NOAA Wind Speed (2008)

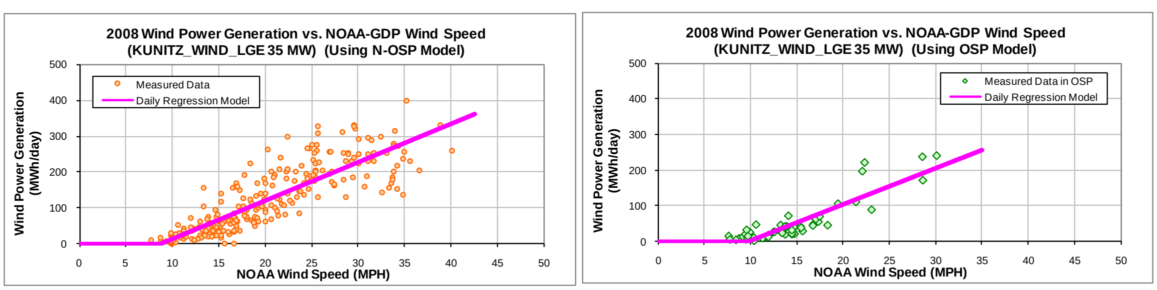


Figure 11-110: KUNITZ_WIND_LGE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-109: KUNITZ_WIND_LGE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-91.9464
Left Slope (MWh/mph-day)	10.6658
RMSE (MWh/day)	48.8934
R2	0.7179
CV-RMSE	39.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-97.9475
Left Slope (MWh/mph-day)	10.1361
RMSE (MWh/day)	27.6648
R2	0.7958
CV-RMSE	55.6%

Table 11-110: KUNITZ_WIND_LGE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	20.47	4,108	3,664	10.79%	17%	15%
Feb-08	27	24.53	4,615	4,582	0.73%	20%	20%
Mar-08	25	20.65	3,106	3,208	-3.27%	15%	15%
Apr-08	30	22.49	3,602	4,438	-23.21%	14%	18%
May-08	24	19.59	2,783	2,807	-0.87%	14%	14%
Jun-08	28	19.21	2,727	3,162	-15.91%	12%	13%
Jul-08	18	14.89	1,006	1,021	-1.49%	7%	7%
Aug-08	24	14.25	934	1,164	-24.67%	5%	6%
Sep-08	14	14.54	737	728	1.27%	6%	6%
Oct-08	29	15.51	1,493	2,131	-42.72%	6%	9%
Nov-08	30	17.79	3,851	2,945	23.54%	15%	12%
Dec-08	27	24.36	5,337	4,467	16.31%	24%	20%
Total	305	19.37	34,300	34,316	-0.05%	13%	13%
Total in OSP (07/15-09/15)	50	14.57	2,314	2,491	-7.65%	6%	6%

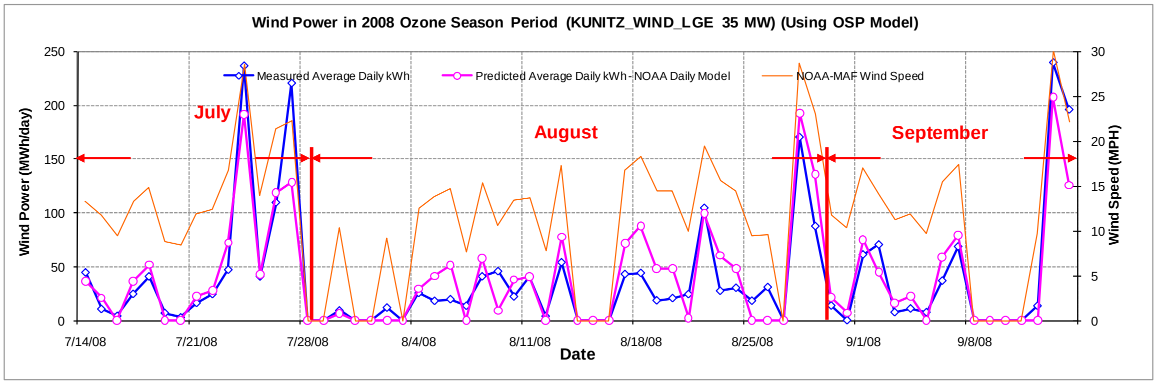


Figure 11-111: KUNITZ_WIND_LGE – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

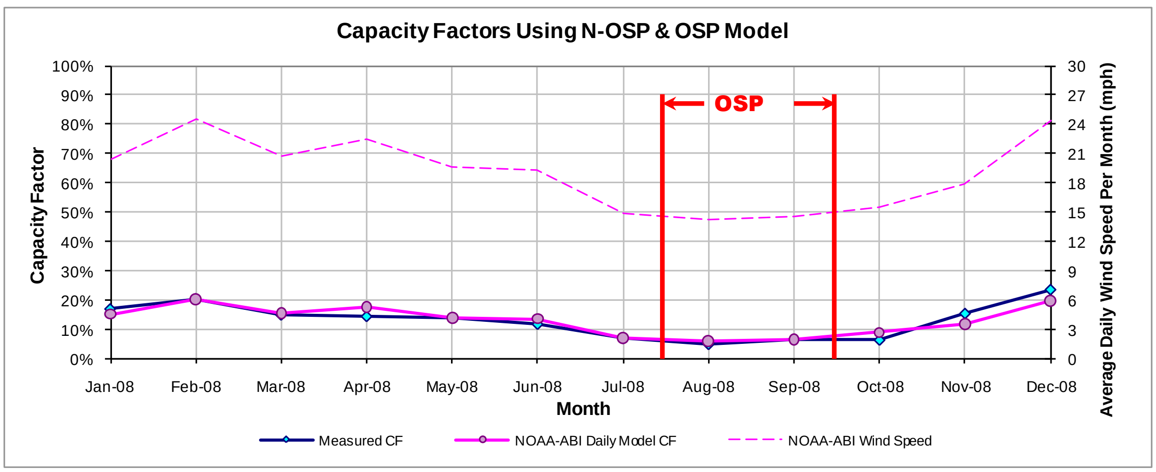


Figure 11-112: KUNITZ_WIND_LGE – Predicted Capacity Factors Using Daily Models (2008)

Table 11-111: KUNITZ_WIND_LGE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
37,111	41,160	41,179

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
44	50	51

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.27 Lone Star – Post Oak Wind (LNCRK_G871)

Table 11-112: Site Information for Lone Star – Post Oak Wind (LNCRK_G871)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
LNCRK2_G871	WIND		Shacklefo rd	May-08	100	Horizon Wind Energy	Lone Star-Post Oak Wind		ERCOT		ONCOR	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
LNCRK2_G871	LNCRK2_G871	100

11.27.1 Lone Star – Post Oak Wind (LNCRK_G871)

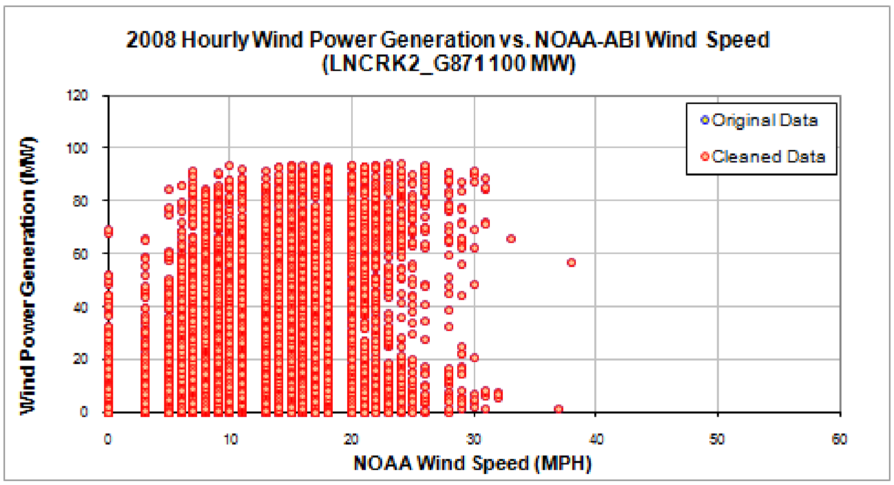


Figure 11-113: LNCRK_G871– Hourly Wind Power vs. NOAA Wind Speed (2008)

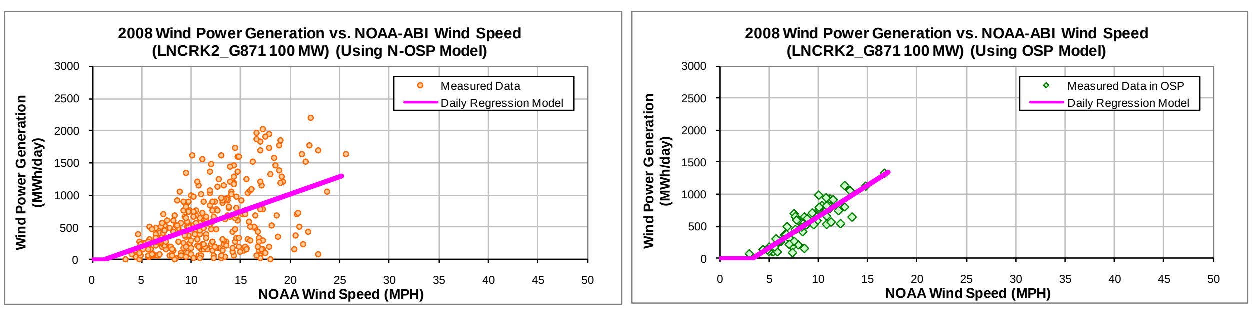


Figure 11-114: LNCRK_G871– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-113: LNCRK_G871– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-62.8756
Left Slope (MWh/mph-day)	54.1134
RMSE (MWh/day)	436.0737
R2	0.2308
CV-RMSE	74.2%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-330.2043
Left Slope (MWh/mph-day)	97.7202
RMSE (MWh/day)	148.9641
R2	0.7669
CV-RMSE	28.6%

Table 11-114: LNCRK_G871– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	3,421	18,168	-431.05%	5%	25%
Feb-08	28	12.53	2,910	17,231	-492.18%	4%	26%
Mar-08	31	13.35	10,473	20,440	-95.17%	14%	27%
Apr-08	30	13.87	15,713	20,624	-31.26%	22%	29%
May-08	31	12.79	20,046	19,502	2.71%	27%	26%
Jun-08	30	13.70	24,494	20,352	16.91%	34%	28%
Jul-08	31	10.58	21,178	19,151	9.57%	28%	26%
Aug-08	31	7.43	12,236	12,314	-0.64%	16%	17%
Sep-08	30	7.95	14,413	12,985	9.91%	20%	18%
Oct-08	31	10.48	23,525	15,624	33.58%	32%	21%
Nov-08	30	10.24	26,686	14,735	44.78%	37%	20%
Dec-08	31	12.20	34,531	18,517	46.38%	46%	25%
Total	364	11.44	209,626	209,645	-0.01%	24%	24%
Total in OSP (07/15-09/15)	63	8.71	32,818	32,851	-0.10%	22%	22%

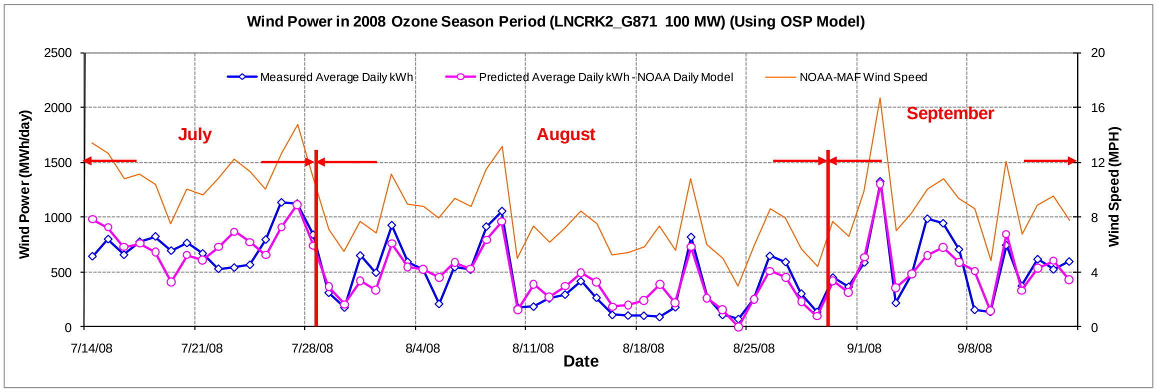


Figure 11-115: LNCRK_G871– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

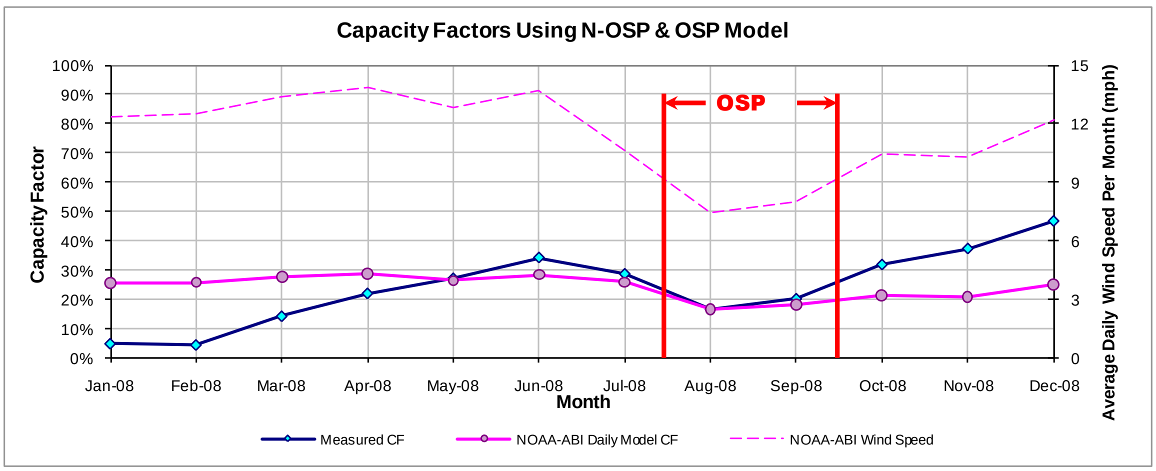


Figure 11-116: LNCRK_G871– Predicted Capacity Factors Using Daily Models (2008)

Table 11-115: LNCRK_G871– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
209,916	210,777	210,797

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
619	521	520

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.28 Lone Star – Post Oak Wind (LNCRK_G872)

Table 11-116: Site Information for Lone Star – Post Oak Wind (LNCRK_G872)

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
LNCRK2_G872	WIND		Shackleford	May-08	100	Horizon Wind Energy	Lone Star-Post Oak Wind		ERCOT		ONCOR	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
LNCRK2_G872	LNCRK2_G872	100

11.28.1 Lone Star – Post Oak Wind (LNCRK_G872)

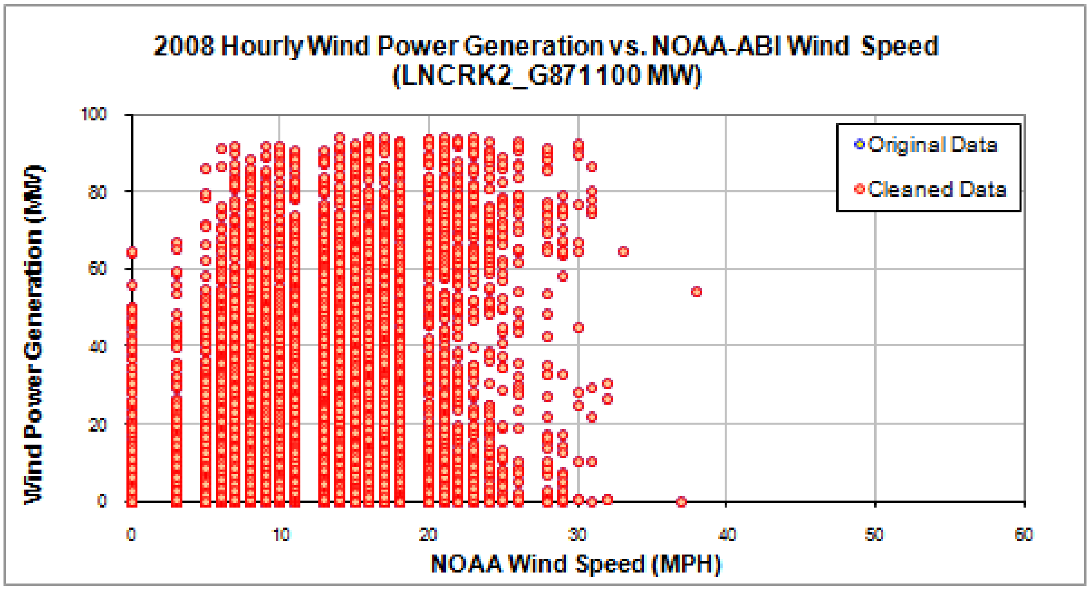
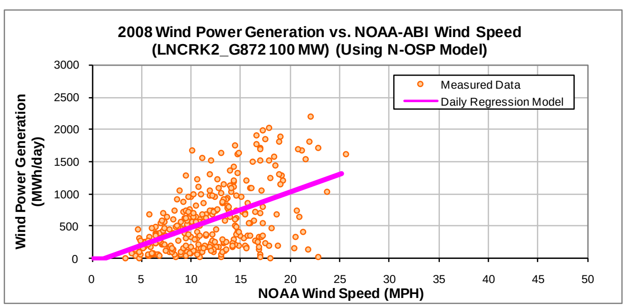


Figure 11-117: LNCRK_G872– Hourly Wind Power vs. NOAA Wind Speed (2008)



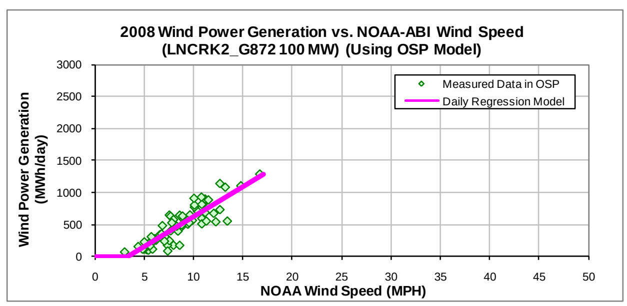


Figure 11-118: LNCRK_G872– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-117: LNCRK_G872– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-62.3286
Left Slope (MWh/mph-day)	54.3534
RMSE (MWh/day)	431.8504
R2	0.2362
CV-RMSE	73%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-311.3303
Left Slope (MWh/mph-day)	93.6503
RMSE (MWh/day)	149.057
R2	0.7512
CV-RMSE	29.6%

Table 11-118: LNCRK_G872– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	4,228	18,273	-332.25%	6%	25%
Feb-08	27	12.67	4,289	16,908	-294.27%	7%	26%
Mar-08	31	13.35	8,091	20,556	-154.06%	11%	28%
Apr-08	30	13.87	16,002	20,741	-29.61%	22%	29%
May-08	31	12.79	19,954	19,614	1.70%	27%	26%
Jun-08	30	13.70	25,075	20,467	18.38%	35%	28%
Jul-08	31	10.58	20,387	18,777	7.89%	27%	25%
Aug-08	31	7.43	12,020	11,955	0.54%	16%	16%
Sep-08	30	7.95	13,803	12,743	7.68%	19%	18%
Oct-08	31	10.48	24,068	15,719	34.69%	32%	21%
Nov-08	30	10.24	26,551	14,825	44.16%	37%	21%
Dec-08	31	12.20	34,725	18,625	46.37%	47%	25%
Total	363	11.45	209,192	209,204	-0.01%	24%	24%
Total in OSP (07/15-09/15)	63	8.71	31,774	31,801	-0.08%	21%	21%

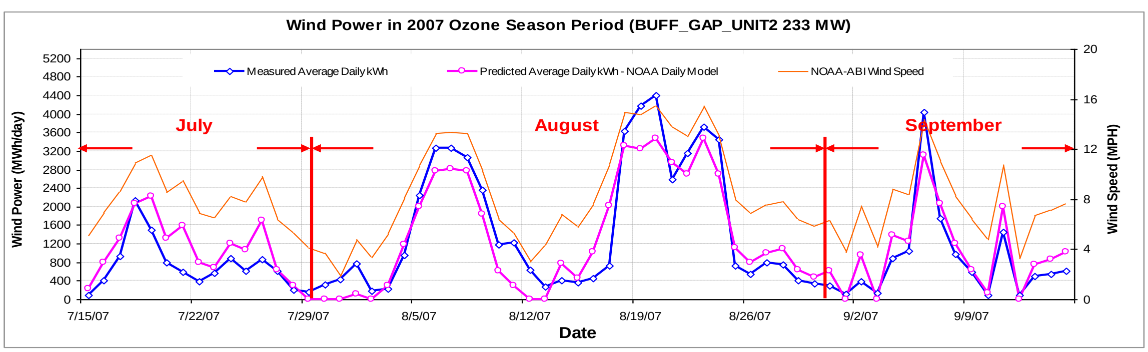


Figure 11-119: LNCRK_G872– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

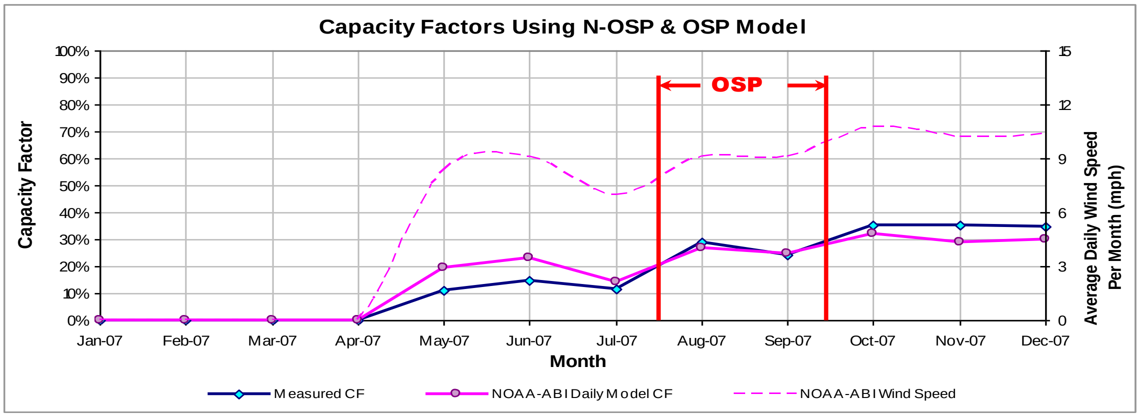


Figure 11-120: LNCRK_G872– Predicted Capacity Factors Using Daily Models (2008)

Table 11-119: LNCRK_G872 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
209,623	210,921	210,933

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
598	504	504

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.29 Lone Star – Mesquite Wind

Table 11-120: Site Information for Lone Star – Mesquite Wind

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
LNCRK_G83	WIND	Abilene	Shackleford	Mar-07	200	Horizon Wind Energy	LNCRK_G83	Vestas 1.8 MW (67)	ERCOT		Oncor	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
LNCRK_G83	LNCRK_G83	200

11.29.1 Lone Star – Mesquite Wind (LNCRK_G83)

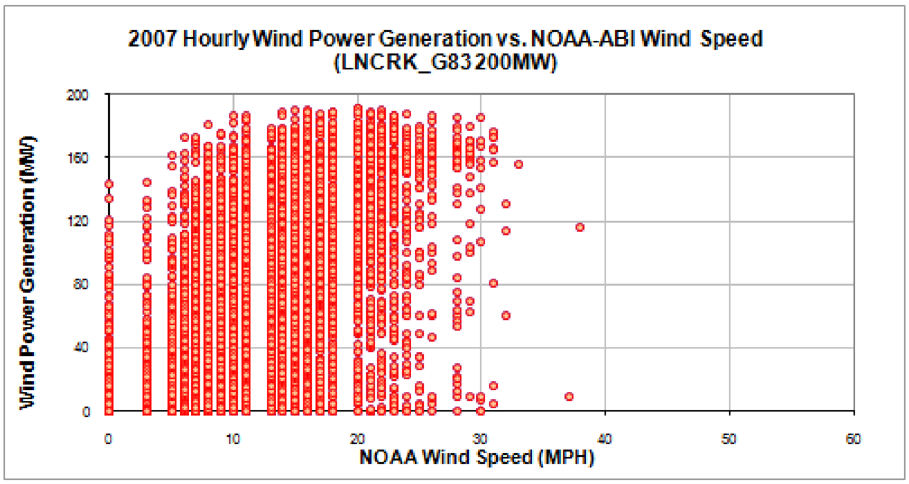


Figure 11-121: LNCRK_G83– Hourly Wind Power vs. NOAA Wind Speed (2008)

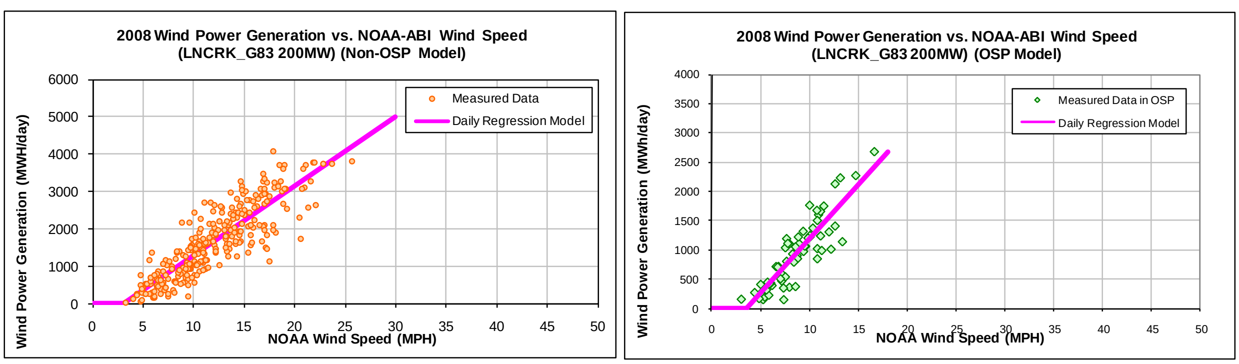


Figure 11-122: LNCRK_G83– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-121: LNCRK_G83– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-581.7381
Left Slope (MWh/mph-day)	186.0489
RMSE (MWh/day)	471.8201
R2	0.7541
CV-RMSE	28.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-672.3913
Left Slope (MWh/mph-day)	185.8624
RMSE (MWh/day)	276.1998
R2	0.7759
CV-RMSE	29.2%

Table 11-122: LNCRK_G83– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	52,559	50,316	4.27%	36%	35%
Feb-08	23	11.75	33,161	36,905	-11.29%	30%	33%
Mar-08	31	13.35	53,172	58,943	-10.85%	36%	40%
Apr-08	29	13.92	57,649	58,227	-1.00%	41%	42%
May-08	31	12.79	54,732	55,719	-1.80%	37%	37%
Jun-08	30	13.70	54,371	59,006	-8.52%	38%	41%
Jul-08	31	10.58	36,911	41,400	-12.16%	25%	28%
Aug-08	31	7.43	22,286	22,091	0.87%	15%	15%
Sep-08	30	7.95	26,440	25,520	3.48%	18%	18%
Oct-08	31	10.48	48,919	42,385	13.36%	33%	28%
Nov-08	29	10.17	43,209	37,997	12.06%	31%	27%
Dec-08	28	11.87	50,589	45,549	9.96%	38%	34%
Total	354	11.32	533,999	534,059	-0.01%	31%	31%
Total in OSP (07/15-09/15)	63	8.71	59,626	59,733	-0.18%	20%	20%

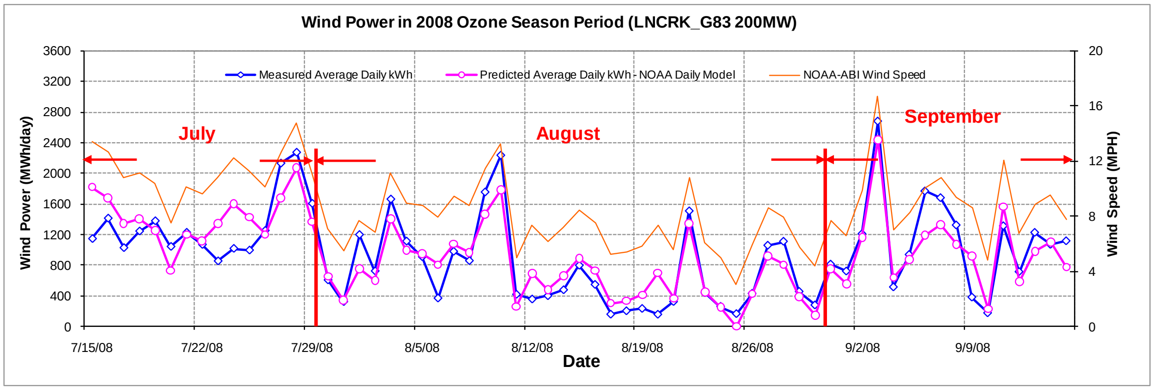


Figure 11-123: LNCRK_G83– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

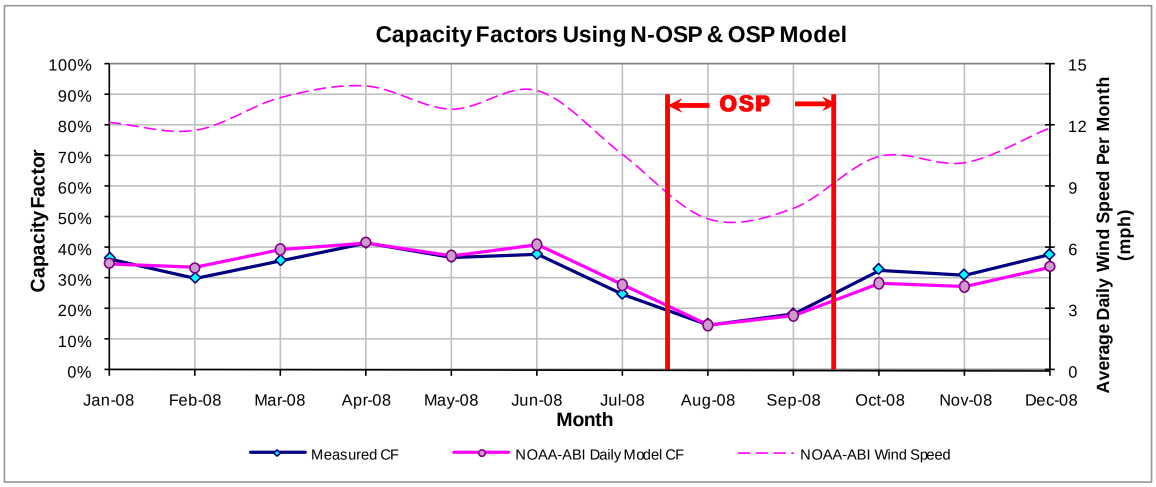


Figure 11-124: LNCRK_G83– Predicted Capacity Factors Using Daily Models (2008)

Table 11-123: LNCRK_G83– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
548,771	552,100	552,162

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
1,132	946	948

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and it was adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.30 Forest Creek Wind Farm

Table 11-124: Site Information for Forest Creek Wind Farm

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
MDCDLD_FCW1	WIND	ABILENE	STERLING	Jan-07	124.2	Airtricity	Forest Creek Wind Farm	Siemens	ERCOT		TXU-ED	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
MCDLD_FCW1	MCDLD_FCW1	124.2

11.30.1 Forest Creek Wind Farm – MDCDLD_FCW1

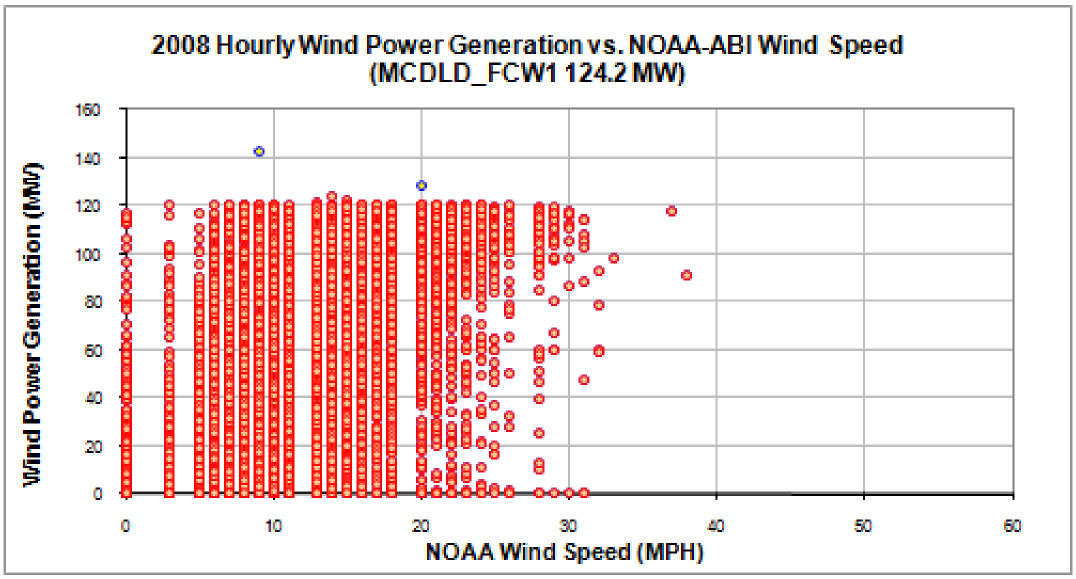


Figure 11-125: MDCDLD_FCW1– Hourly Wind Power vs. NOAA Wind Speed (2008)

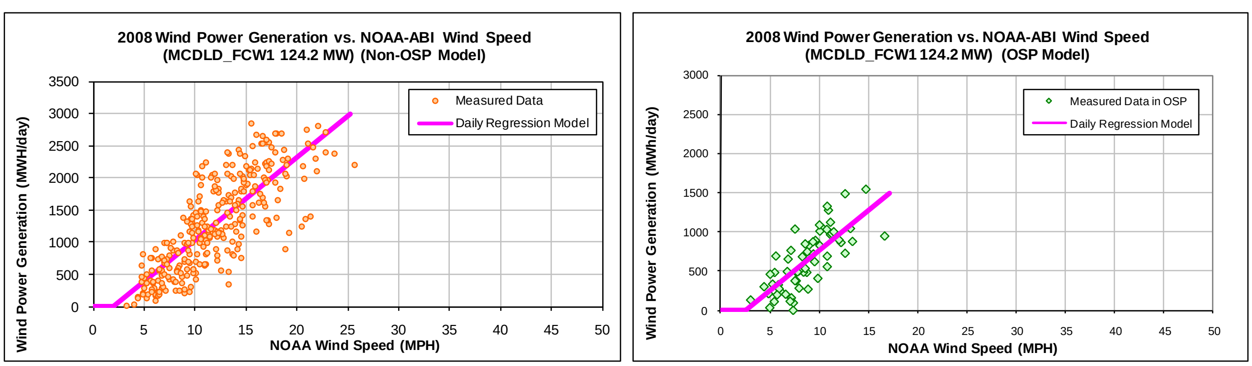


Figure 11-126: MDCDLD_FCW1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-125: MDCDLD_FCW1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-261.5804
Left Slope (MWh/mph-day)	129.129
RMSE (MWh/day)	436.5066
R2	0.6315
CV-RMSE	34%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-262.3229
Left Slope (MWh/mph-day)	102.7236
RMSE (MWh/day)	244.0834
R2	0.5759
CV-RMSE	38.3%

Table 11-126: MDCDLD_FCW1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	37,227	39,188	-5.27%	42%	44%
Feb-08	29	12.36	43,837	38,706	11.70%	51%	45%
Mar-08	31	13.35	48,250	45,317	6.08%	52%	49%
Apr-08	30	13.87	41,007	45,869	-11.86%	46%	51%
May-08	31	12.79	44,381	43,080	2.93%	48%	47%
Jun-08	30	13.70	37,909	45,219	-19.28%	42%	51%
Jul-08	31	10.58	30,702	29,438	4.12%	33%	32%
Aug-08	30	7.47	14,623	15,163	-3.69%	16%	17%
Sep-08	30	7.95	13,970	19,308	-38.21%	16%	22%
Oct-08	31	10.48	35,361	33,826	4.34%	38%	37%
Nov-08	30	10.24	33,773	31,816	5.80%	38%	36%
Dec-08	31	12.20	46,655	40,729	12.70%	50%	44%
Total	364	11.43	427,695	427,658	0.01%	39%	39%
Total in OSP (07/15-09/15)	62	8.75	39,469	39,465	0.01%	21%	21%

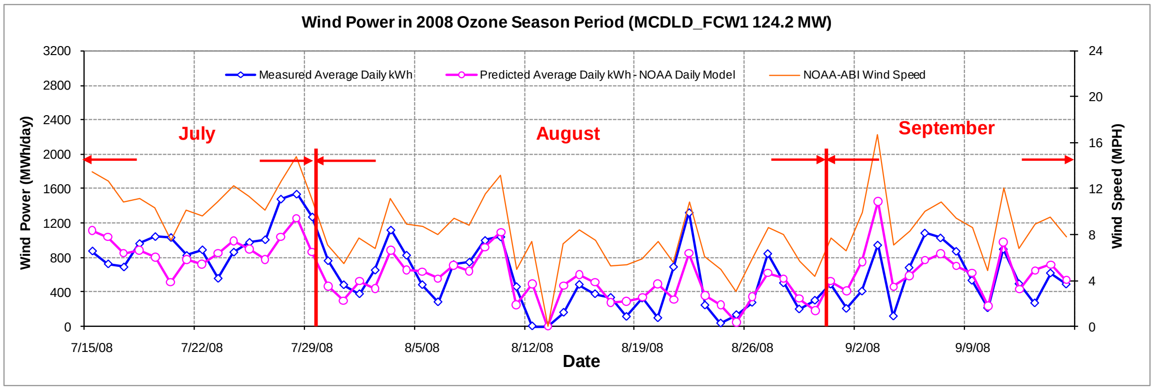


Figure 11-127: MDCDLD_FCW1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

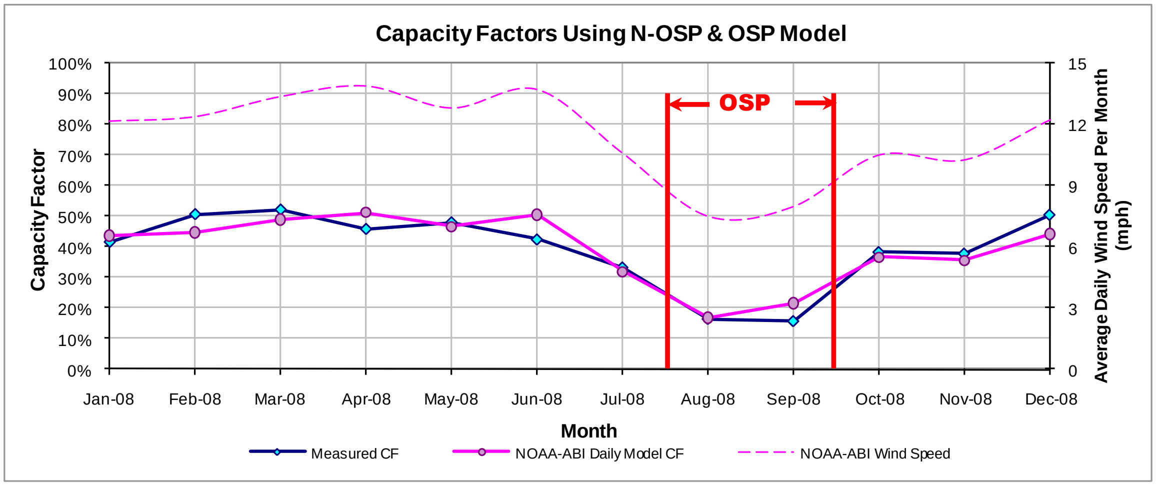


Figure 11-128: MDCDLD_FCW1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-127: MDCDLD_FCW1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
420,543	430,045	430,007

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
735	637	637

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.31 Sand Bluff Wind Farm

Table 11-128: Site Information for Sand Bluff Wind Farm

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
MDCDLD_SBW1	WIND	ABILENE	STERLING	Jan-07	90	Airtricity	Sand Bluff Wind Farm	Siemens	ERCOT		TXU-ED	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
MCDLD_SBW1	MCDLD_SBW2	90

11.31.1 Sand Bluff Wind Farm – MCDLDSBW1

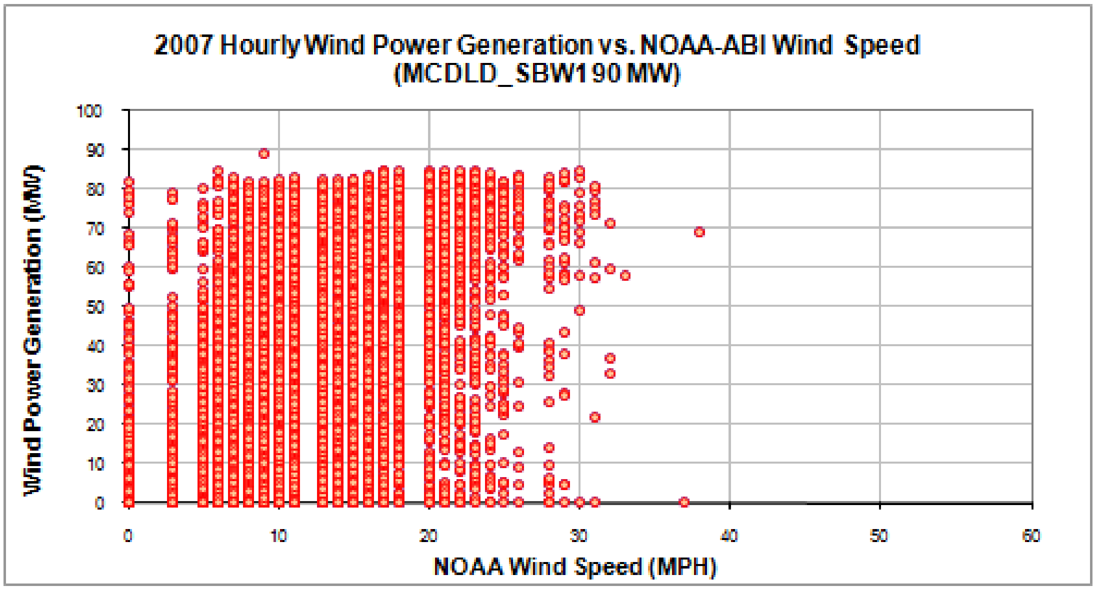
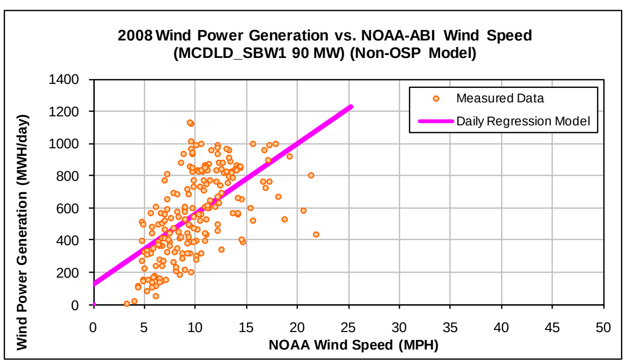


Figure 11-129: MCDLDSBW1– Hourly Wind Power vs. NOAA Wind Speed (2008)



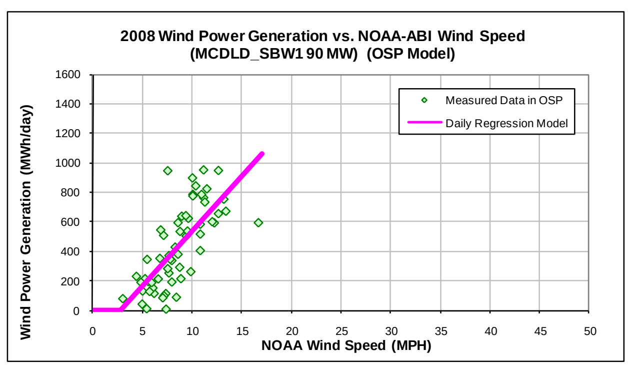


Figure 11-130: MCDLDSBW1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-129: MCDLDSBW1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	127.3112
Left Slope (MWh/mph-day)	43.7602
RMSE (MWh/day)	213.4878
R2	0.3527
CV-RMSE	37.8%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-207.3415
Left Slope (MWh/mph-day)	74.6087
RMSE (MWh/day)	191.313
R2	0.522
CV-RMSE	43.9%

Table 11-130: MCDLDSBW1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	22	10.37	11,989	12,780	-6.59%	25%	27%
Feb-08	18	10.90	10,842	10,879	-0.34%	28%	28%
Mar-08	21	12.76	13,294	14,395	-8.28%	29%	32%
Apr-08	21	12.19	13,443	13,877	-3.23%	30%	31%
May-08	19	10.69	13,197	11,310	14.30%	32%	28%
Jun-08	16	9.81	9,540	8,904	6.67%	28%	26%
Jul-08	26	10.15	17,036	14,632	14.11%	30%	26%
Aug-08	30	7.49	9,408	10,534	-11.96%	15%	16%
Sep-08	29	7.85	9,247	12,865	-39.13%	15%	21%
Oct-08	19	8.29	9,714	9,313	4.12%	24%	23%
Nov-08	19	8.19	8,677	9,225	-6.32%	21%	22%
Dec-08	18	9.02	11,735	9,399	19.91%	30%	24%
Total	258	9.69	138,123	138,113	0.01%	25%	25%
Total in OSP (07/15-09/15)	60	8.62	26,155	26,152	0.01%	20%	20%

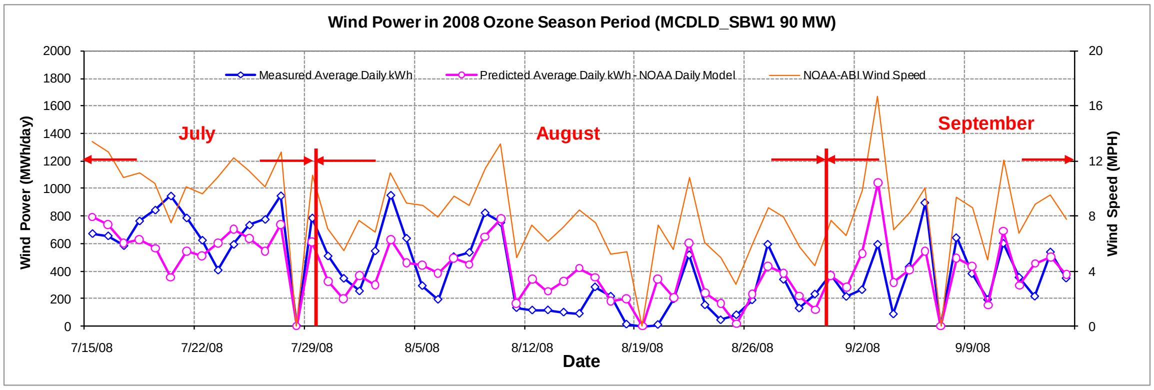


Figure 11-131: MCDLDSBW1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

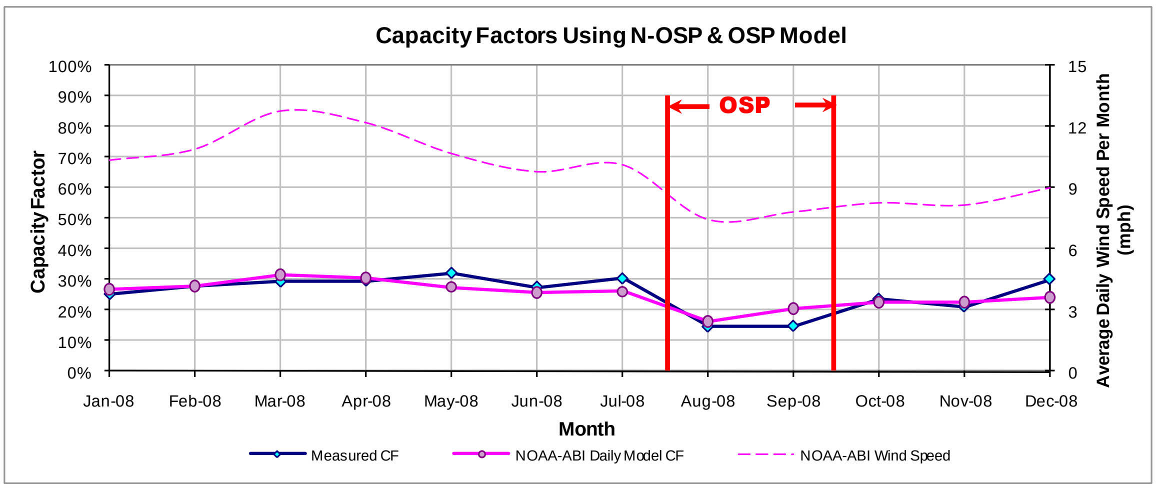


Figure 11-132: MCDLDSBW1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-131: MCDLDSBW1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
224,617	195,407	195,392

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
517	436	438

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.32 Red Canyon 1

Table 11-132: Site Information for Red Canyon 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
LNCRK_G83	WIND	Abilene	Shackleford	Mar-07	200	Horizon Wind Energy	LNCRK_G83	Vestas 1.8 MW (67)	ERCOT		Oncor	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
LNCRK_G83	LNCRK_G83	200

11.32.1 Red Canyon 1 – RDCANYON_RDCNY1

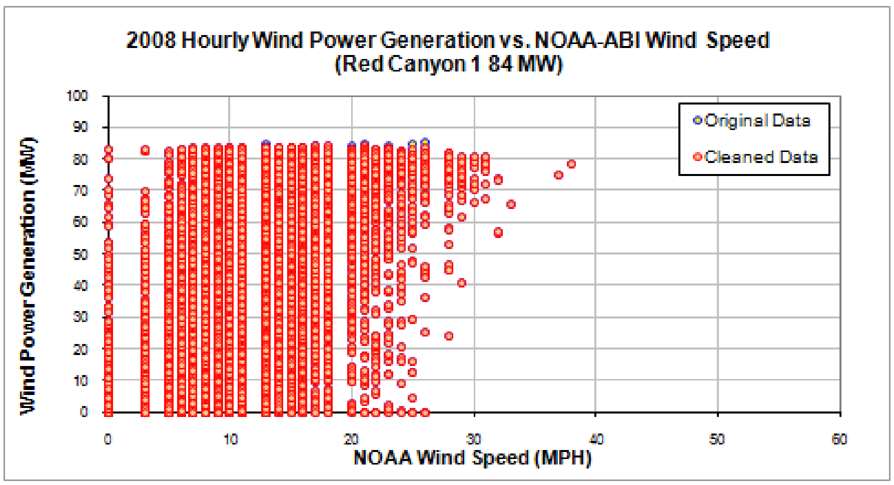
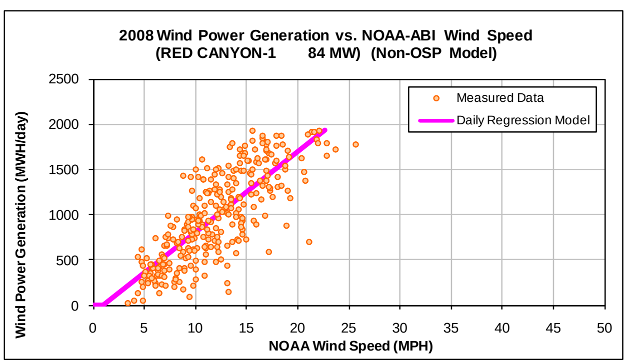


Figure 11-133: RDCANYON_RDCNY1– Hourly Wind Power vs. NOAA Wind Speed (2008)



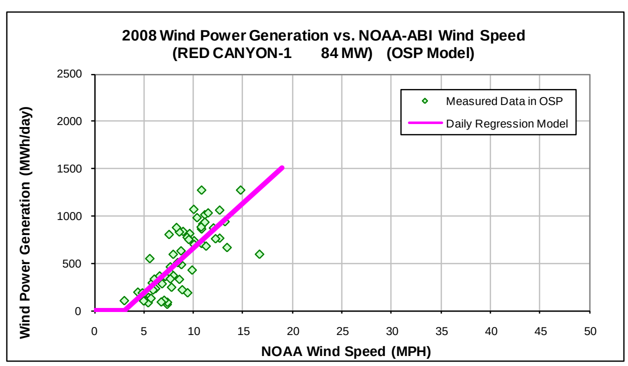


Figure 11-134: RDCANYON_RDCNY1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-133: RDCANYON_RDCNY1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-85.8013
Left Slope (MWh/mph-day)	88.8171
RMSE (MWh/day)	308.9992
R2	0.6145
CV-RMSE	31.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-285.1843
Left Slope (MWh/mph-day)	94.4763
RMSE (MWh/day)	221.7219
R2	0.5813
CV-RMSE	41.2%

Table 11-134: RDCANYON_RDCNY1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	31,366	30,341	3.27%	52%	50%
Feb-08	28	12.53	27,219	28,769	-5.69%	48%	51%
Mar-08	31	13.35	34,380	34,088	0.85%	55%	55%
Apr-08	30	13.87	31,864	34,373	-7.87%	53%	57%
May-08	31	12.79	31,717	32,549	-2.62%	51%	52%
Jun-08	29	13.45	28,756	32,165	-11.85%	49%	55%
Jul-08	31	10.58	25,095	24,101	3.96%	40%	39%
Aug-08	31	7.43	12,950	12,927	0.17%	21%	21%
Sep-08	30	7.95	13,902	16,387	-17.87%	23%	27%
Oct-08	31	10.48	28,952	26,184	9.56%	46%	42%
Nov-08	30	10.24	28,224	24,707	12.46%	47%	41%
Dec-08	31	12.20	33,122	30,932	6.61%	53%	49%
Total	363	11.42	327,546	327,522	0.01%	45%	45%
Total in OSP (07/15-09/15)	63	8.71	33,874	33,873	0.01%	27%	27%

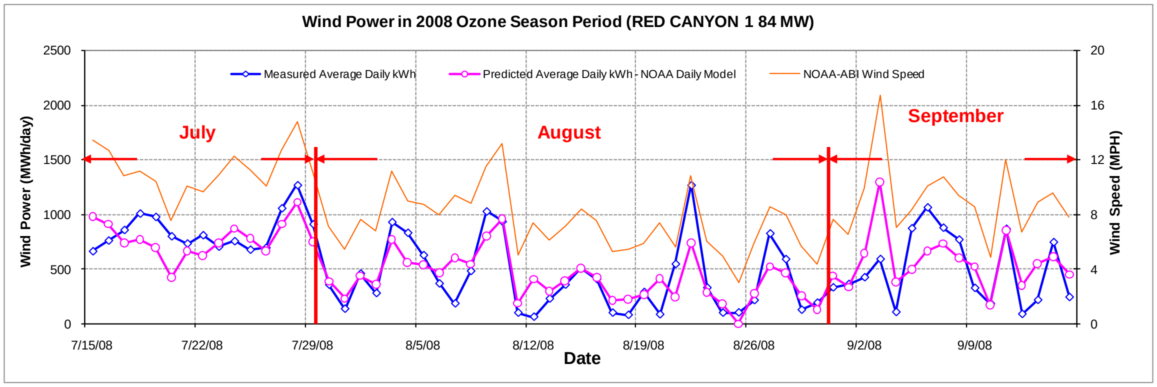


Figure 11-135: RDCANYON_RDCNY1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

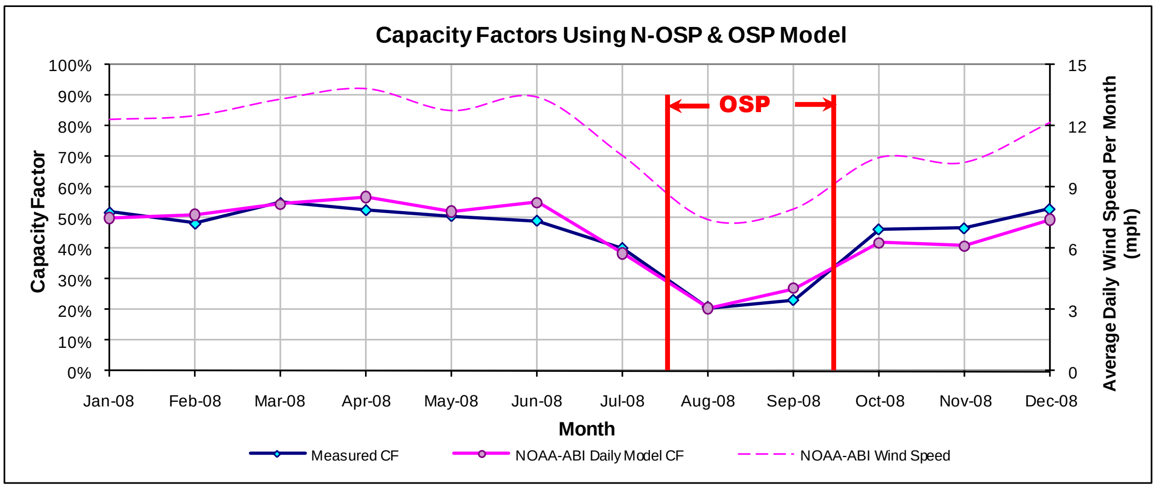


Figure 11-136: RDCANYON_RDCNY1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-135: RDCANYON_RDCNY1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
325,652	330,253	330,229

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
632	538	538

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.33 Big Spring Wind Power

Table 11-136: Site Information for Big Spring Wind Power

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SGMTN	WIND	Big Spring	HOWARD	Feb-99	41	York Research	Big Spring Wind Power	Vestas V-47 (42) Vestas (4)	ERCOT	TXU	TXU	MAF	34MW-Feb99 6.6MW-Jul 99

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SGMTN_SIGNALMT	SGMTN	41

11.33.1 Big Spring Wind Power – SGMTN_SIGNALMT

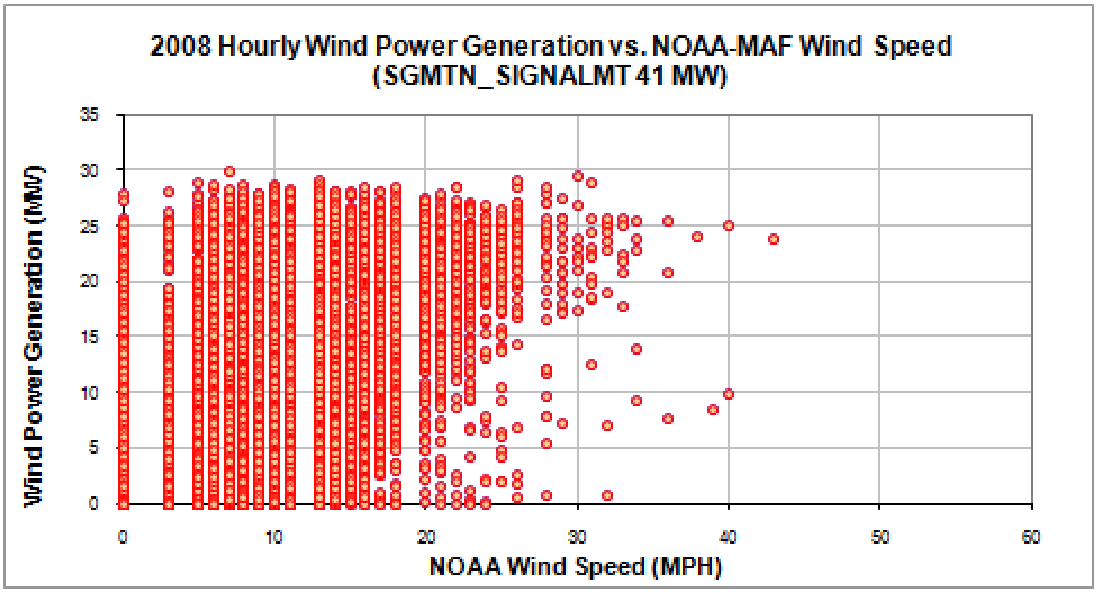


Figure 11-137: SGMTN_SIGNALMT – Hourly Wind Power vs. NOAA Wind Speed (2008)

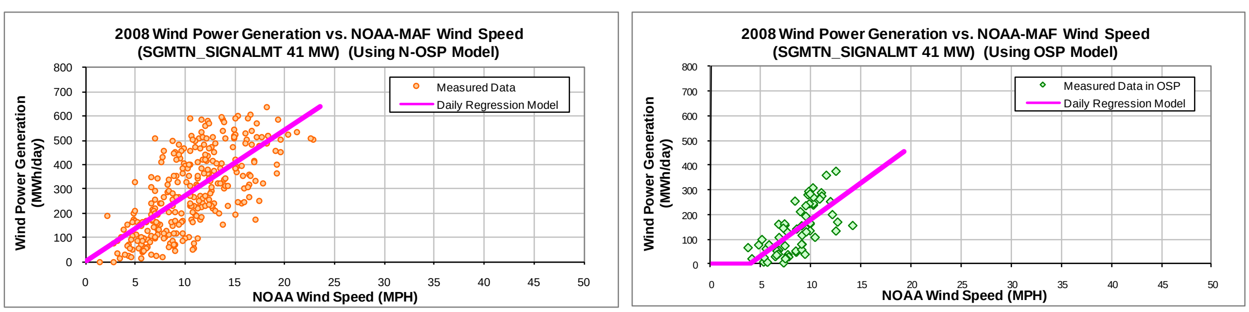


Figure 11-138: SGMTN_SIGNALMT – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-137: SGMTN_SIGNALMT – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-1.5431
Left Slope (MWh/mph-day)	27.1749
RMSE (MWh/day)	119.2536
R2	0.4737
CV-RMSE	41.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-113.0763
Left Slope (MWh/mph-day)	29.5313
RMSE (MWh/day)	73.395
R2	0.4581
CV-RMSE	51.9%

Table 11-138: SGMTN_SIGNALMT – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	9.30	9,123	7,787	14.65%	30%	26%
Feb-08	29	10.75	9,408	8,427	10.43%	33%	30%
Mar-08	30	12.39	10,422	10,051	3.57%	35%	34%
Apr-08	29	11.59	8,962	9,091	-1.44%	31%	32%
May-08	30	12.55	8,506	10,184	-19.72%	29%	34%
Jun-08	30	13.89	8,334	11,281	-35.37%	28%	38%
Jul-08	31	11.22	6,754	7,915	-17.20%	22%	26%
Aug-08	31	8.09	3,278	3,900	-18.95%	11%	13%
Sep-08	29	6.58	3,135	3,837	-22.40%	11%	13%
Oct-08	31	9.02	8,802	7,552	14.20%	29%	25%
Nov-08	30	8.29	8,229	6,716	18.39%	28%	23%
Dec-08	31	9.94	10,117	8,327	17.70%	33%	27%
Total	362	10.30	95,072	95,067	0.00%	27%	27%
Total in OSP (07/15-09/15)	62	8.62	8,774	8,775	-0.02%	14%	14%

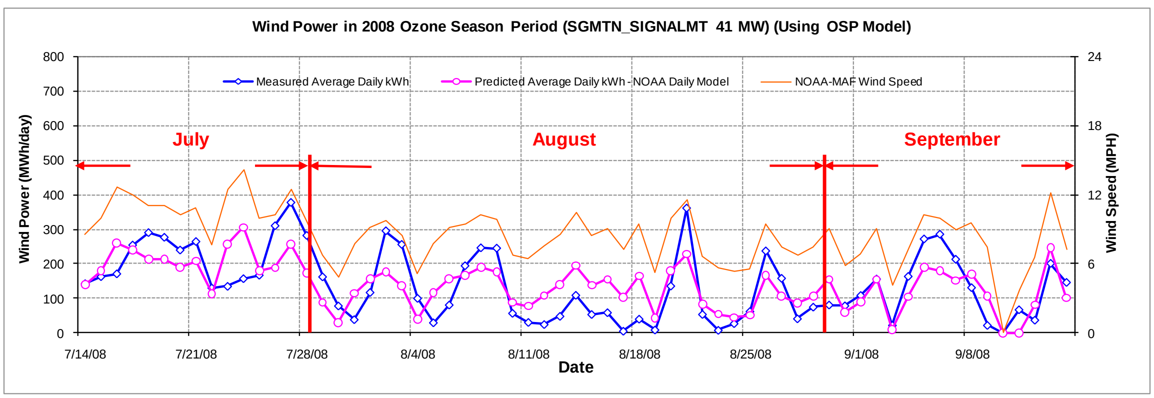


Figure 11-139: SGMTN_SIGNALMT – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

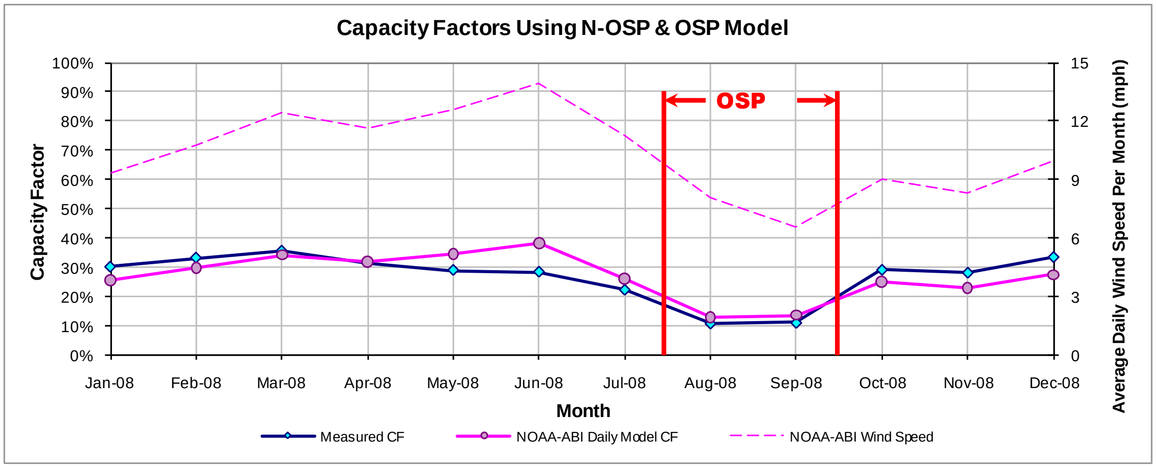


Figure 11-140: SGMTN_SIGNALMT – Predicted Capacity Factors Using Daily Models (2008)

Table 11-139: SGMTN_SIGNALMT – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
101,964	96,122	96,118

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
167	142	142

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.34 Station Wind Energy

Table 11-140: Site Information for Station Wind Energy

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEC_G1	WIND		Martin	Jan-08	124	Invenergy	Stanton Wind Energy	GE Energy	ERCOT		ONCOR	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEC_G1	SWEC_G1	124

11.34.1 Station Wind Energy – SWEC_G1

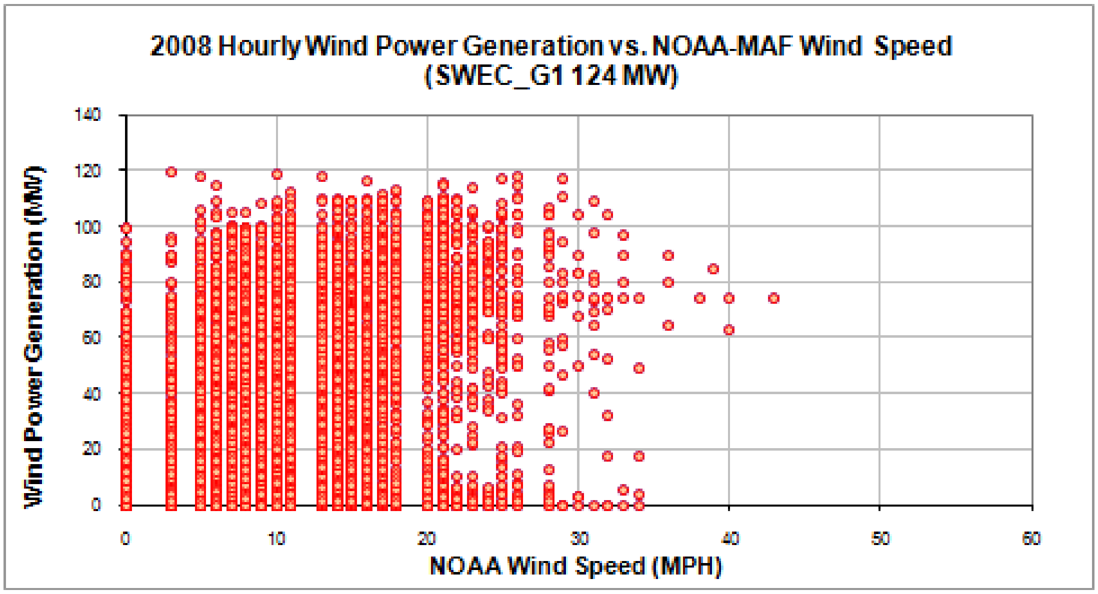


Figure 11-141: SWEC_G1 – Hourly Wind Power vs. NOAA Wind Speed (2008)

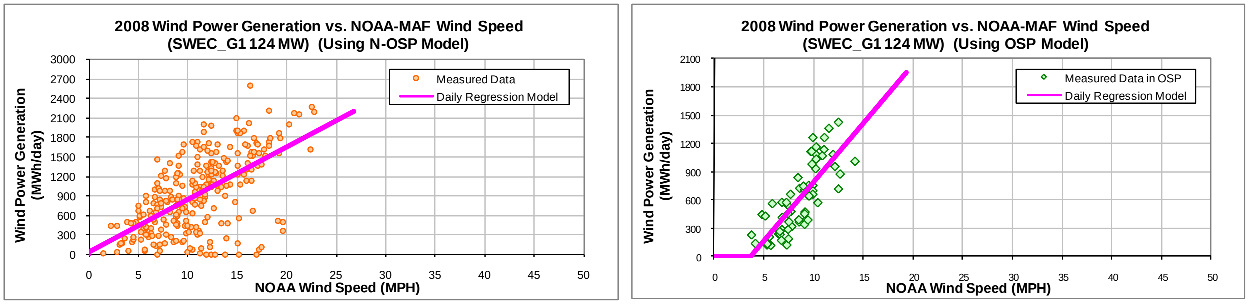


Figure 11-142: SWEC_G1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-141: SWEC_G1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	30.9603
Left Slope (MWh/mph-day)	81.2284
RMSE (MWh/day)	467.0755
R2	0.3576
CV-RMSE	50.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-450.9268
Left Slope (MWh/mph-day)	124.5016
RMSE (MWh/day)	224.1914
R2	0.6169
CV-RMSE	36%

Table 11-142: SWEC_G1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	3	15.26	0	3,812	-40527854.89%	0%	43%
Feb-08	26	10.69	3,818	23,373	-512.16%	5%	30%
Mar-08	30	12.39	22,350	31,109	-39.19%	25%	35%
Apr-08	30	11.95	32,725	30,058	8.15%	37%	34%
May-08	31	12.81	36,805	33,224	9.73%	40%	36%
Jun-08	30	13.89	38,377	34,788	9.35%	43%	39%
Jul-08	31	11.22	29,545	28,565	3.32%	32%	31%
Aug-08	31	8.09	14,661	17,240	-17.59%	16%	19%
Sep-08	29	6.58	13,569	14,366	-5.87%	16%	17%
Oct-08	31	9.02	28,264	23,677	16.23%	31%	26%
Nov-08	30	8.29	30,067	21,141	29.69%	34%	24%
Dec-08	31	9.94	37,185	25,993	30.10%	40%	28%
Total	333	10.49	287,367	287,346	0.01%	29%	29%
Total in OSP (07/15-09/15)	62	8.62	38,589	38,584	0.01%	21%	21%

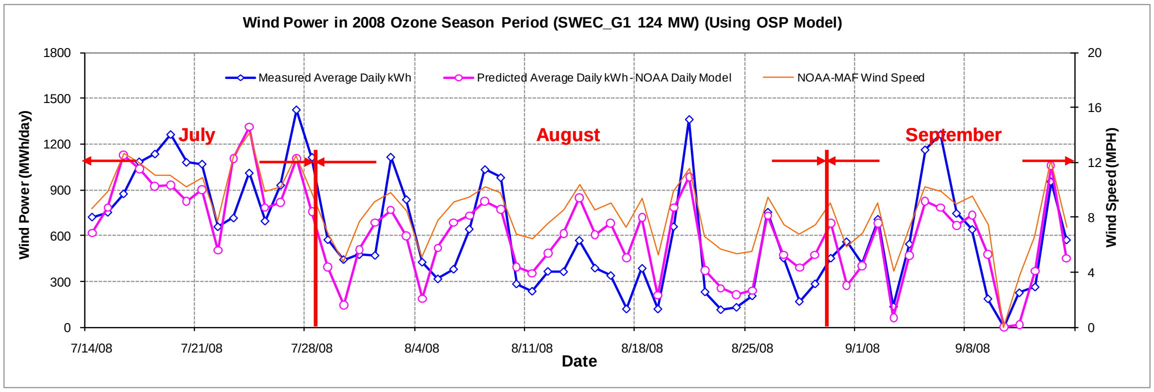


Figure 11-143: SWEC_G1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

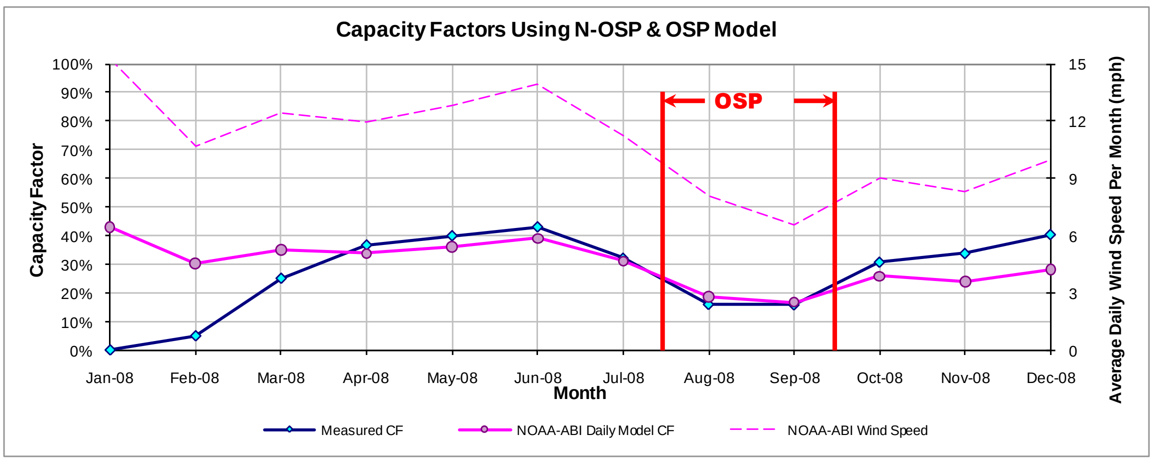


Figure 11-144: SWEC_G1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-143: SWEC_G1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
330,028	315,845	315,822

1999 (Jan-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jan-Dec) Measured MWh/yr	2008 (Jan-Dec) Predicted MWh/yr (2008 Daily Model)
303,068	290,819	290,798

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
728	622	622

Note: The 2008 (1/22-12/31) Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 337 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.35 Southwest Mesa Wind Project

Table 11-144: Site Information for Southwest Mesa Wind Project

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SW_MESA	WIND	McCamey	UPTON	Jun-99	75	FPL Energy	Southwest Mesa Wind Project	NEG Micon (107)	ERCOT	AEP-West	WTU	MAF	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SW_MESA_SW_MESA	SW_MESA	75

11.35.1 Southwest Mesa Wind Project – SW_MESA_SW_MESA

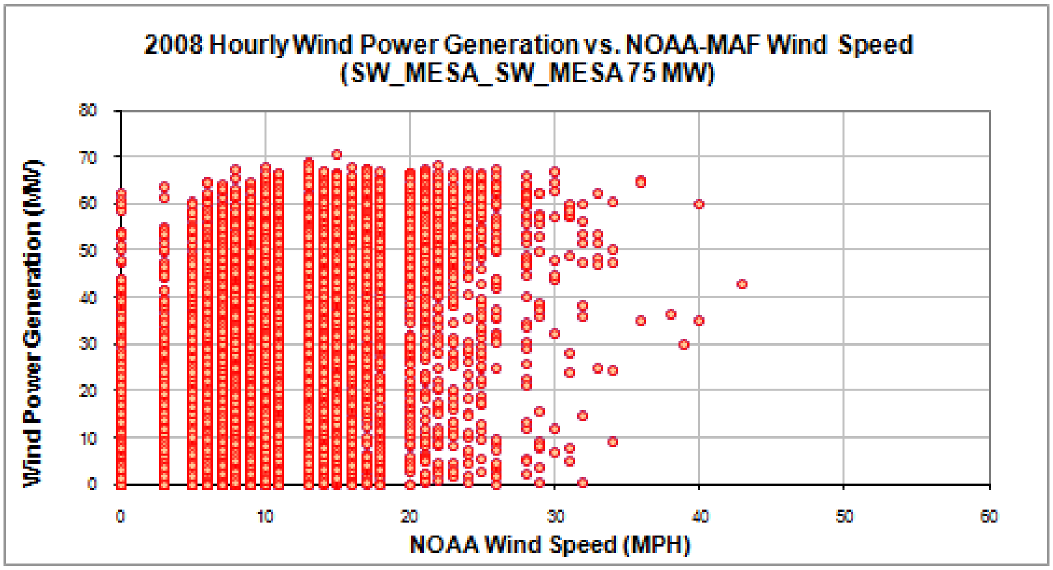
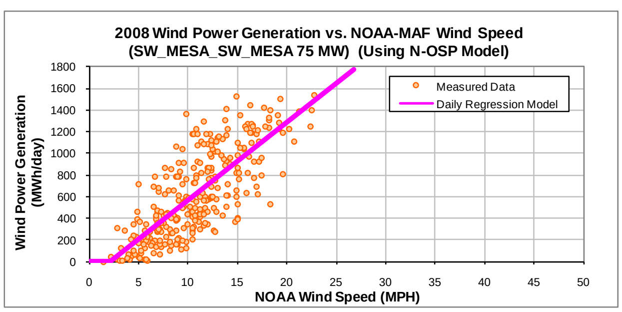


Figure 11-145:SW_MESA_SW_MESA – Hourly Wind Power vs. NOAA Wind Speed (2008)



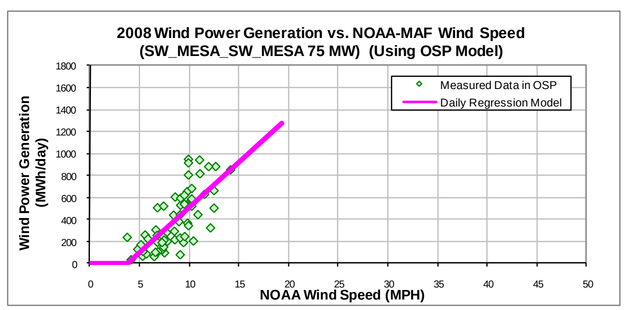


Figure 11-146: SW_MESA_SW_MESA – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-145: SW_MESA_SW_MESA – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-157.1804
Left Slope (MWh/mph-day)	72.3124
RMSE (MWh/day)	254.0017
R2	0.5935
CV-RMSE	41.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-317.1003
Left Slope (MWh/mph-day)	82.7045
RMSE (MWh/day)	179.3076
R2	0.5262
CV-RMSE	45.3%

Table 11-146: SW_MESA_SW_MESA – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	9.30	17,392	15,975	8.15%	31%	29%
Feb-08	29	10.75	18,129	17,985	0.80%	35%	35%
Mar-08	30	12.39	19,742	22,152	-12.21%	37%	41%
Apr-08	30	11.95	19,668	21,217	-7.87%	37%	40%
May-08	31	12.81	22,227	23,850	-7.30%	40%	43%
Jun-08	30	13.89	26,470	25,427	3.94%	49%	47%
Jul-08	31	11.22	21,727	19,364	10.88%	39%	35%
Aug-08	31	8.09	9,585	10,908	-13.80%	17%	20%
Sep-08	29	6.58	6,837	8,138	-19.02%	13%	16%
Oct-08	31	9.02	18,335	15,406	15.98%	33%	28%
Nov-08	30	8.29	13,882	13,278	4.35%	26%	25%
Dec-08	31	9.94	17,073	17,413	-1.99%	31%	31%
Total	364	10.36	211,069	211,113	-0.02%	32%	32%
Total in OSP (07/15-09/15)	62	8.62	24,545	24,550	-0.02%	22%	22%

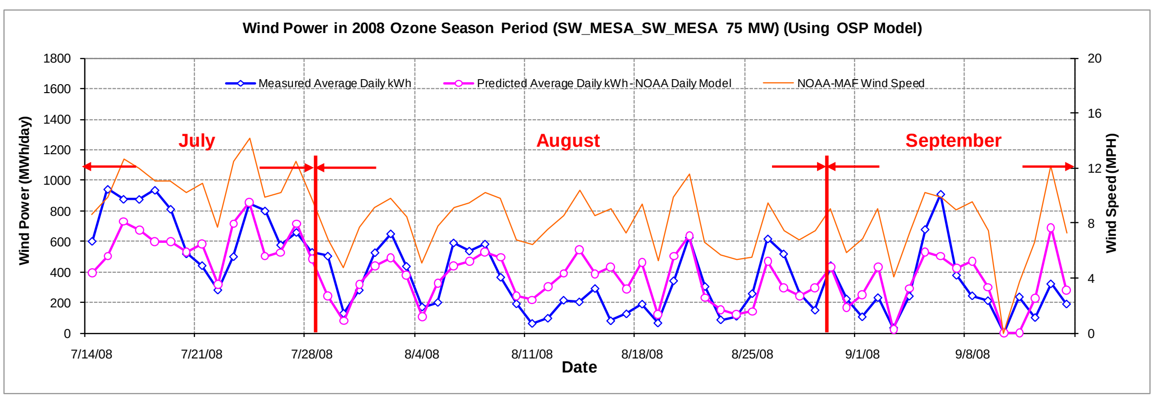


Figure 11-147: SW_MESA_SW_MESA – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

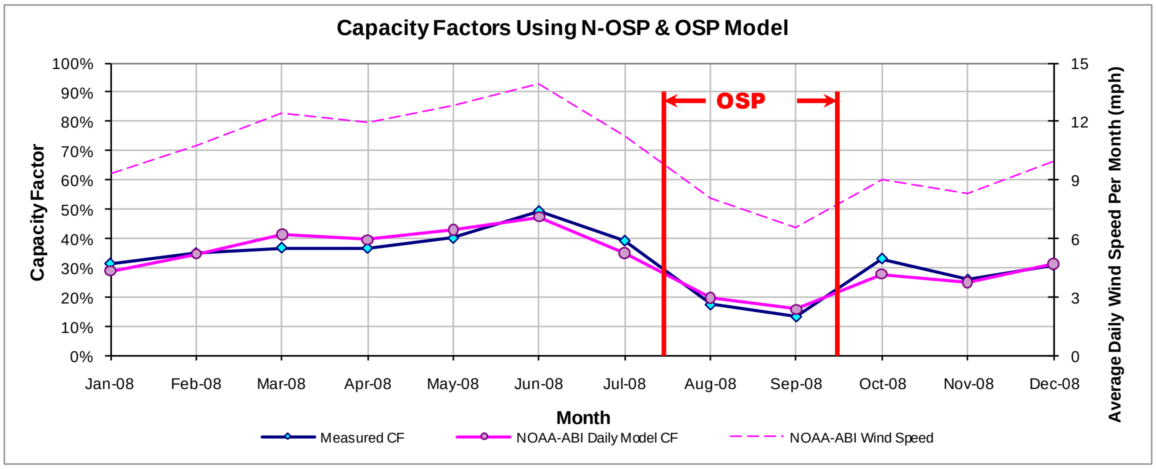


Figure 11-148: SW_MESA_SW_MESA – Predicted Capacity Factors Using Daily Models (2008)

Table 11-147: SW_MESA_SW_MESA – Predicted Power Production in 1999

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
226,536	212,229	212,273

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
466	396	396

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.36 Sweetwater Wind 1

Table 11-148: Site Information for Sweetwater Wind 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWND	WIND	Sweetwater	NOLAN	Dec-03	37.5	DKR Development	Sweetwater Wind 1	GE Wind 1500 (25)	ERCOT	LCRA	LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWND_WND1	SWEETWND	37.5

11.36.1 Sweetwater Wind 1 – SWEETWND_WND1

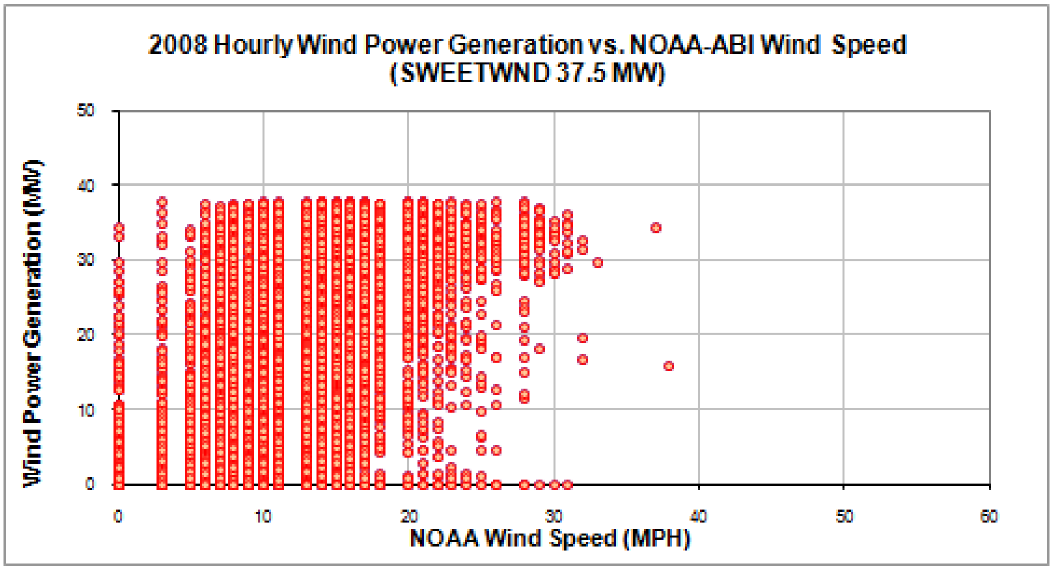


Figure 11-149: SWEETWND_WND1– Hourly Wind Power vs. NOAA Wind Speed (2008)

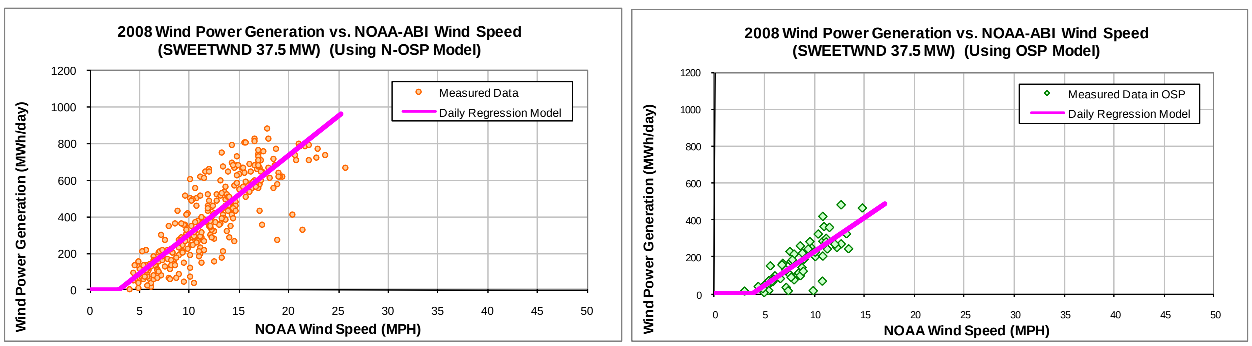


Figure 11-150: SWEETWND_WND1– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-149: SWEETWND_WND1– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-128.5974
Left Slope (MWh/mph-day)	43.2575
RMSE (MWh/day)	118.5994
R2	0.7204
CV-RMSE	30.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-140.2249
Left Slope (MWh/mph-day)	36.7336
RMSE (MWh/day)	71.5994
R2	0.6507
CV-RMSE	40.3%

Table 11-150: SWEETWND_WND1– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH)	Measured Power Generation (MWh)	Predicted Power Generation Using Daily Model (MWh)	Diff.	CV-RMSE	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	12.05	11,636	12,169	-4.58%	43.53%	42%	44%
Feb-08	29	12.27	12,055	11,660	3.28%	26.80%	46%	45%
Mar-08	31	13.32	14,429	13,879	3.81%	26.12%	52%	50%
Apr-08	28	13.57	11,880	12,837	-8.06%	24.23%	47%	51%
May-08	30	12.71	11,707	12,632	-7.90%	24.89%	43%	47%
Jun-08	30	13.70	12,084	13,919	-15.18%	29.95%	45%	52%
Jul-08	31	10.58	8,583	8,819	-2.75%	28.22%	31%	32%
Aug-08	29	7.48	4,024	3,930	2.32%	42.15%	15%	15%
Sep-08	26	7.54	3,772	4,391	-16.40%	47.15%	16%	19%
Oct-08	30	10.69	11,304	10,013	11.42%	37.51%	42%	37%
Nov-08	30	10.21	11,166	9,397	15.85%	39.04%	41%	35%
Dec-08	31	12.20	13,362	12,374	7.40%	25.66%	48%	44%
Total	356	11.41	126,001	126,020	-0.01%	31.63%	39%	39%
Total in OSP (07/15-09/15)	57	177.57	10,150	280,104	-2659.66%	41.71%	20%	546%

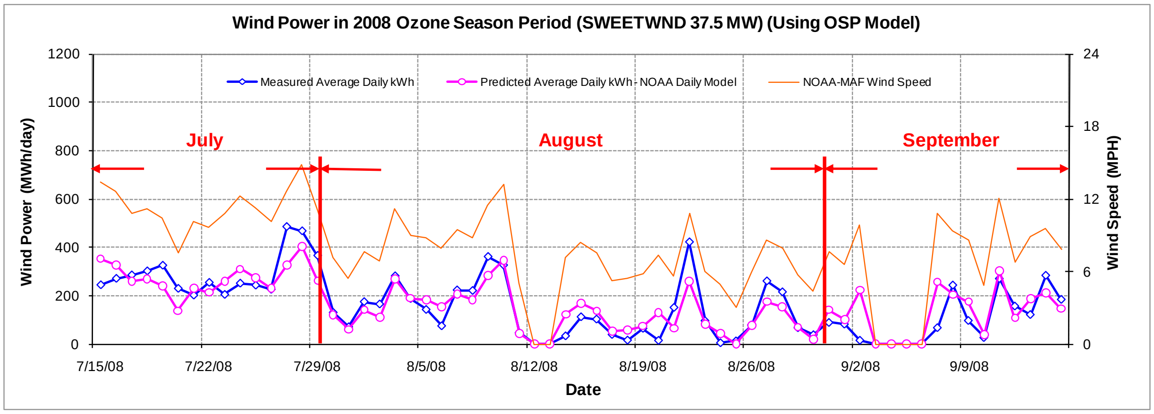


Figure 11-151: SWEETWND_WND1– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

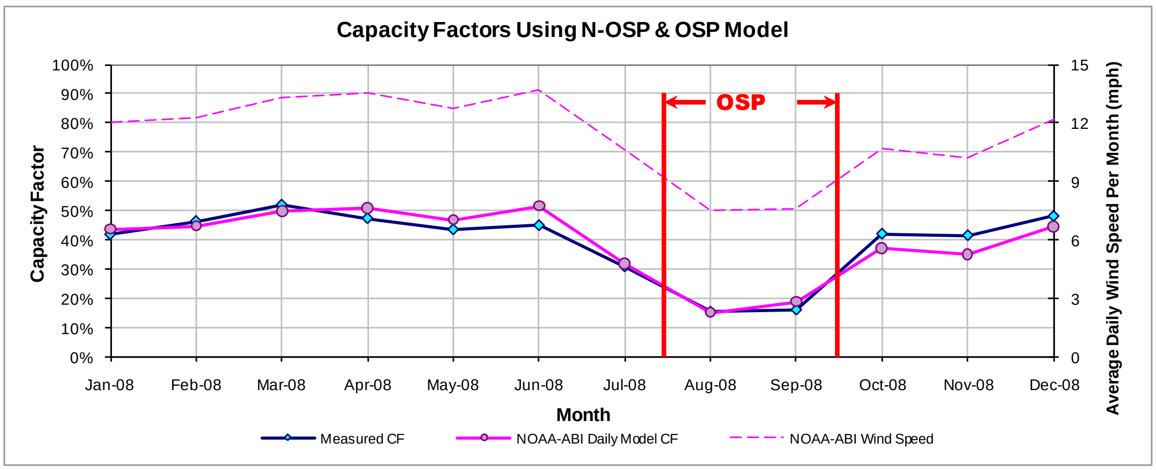


Figure 11-152: SWEETWND_WND1– Predicted Capacity Factors Using Daily Models (2008)

Table 11-151: SWEETWND_WND1– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
126,648	129,560	4,582,395

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
216	178	178

Note: The 2008 Measured MWh/yr presented in the above table includes only validated data and was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.37 Sweetwater Wind 2 (SWEETWN2_WND2)

Table 11-152: Site Information for Sweetwater Wind 2 – SWEETWN2_WND2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN2	WIND	Sweetwater	NOLAN	Feb-05	91.5	DKRW Development	Sweetwater Wind 2	GE Wind 1500 (61)	ERCOT	TXU	TXU	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN2_WND2	SWEETWN2	91.5

11.37.1 Sweetwater Wind 2 – SWEETWN2_WND2

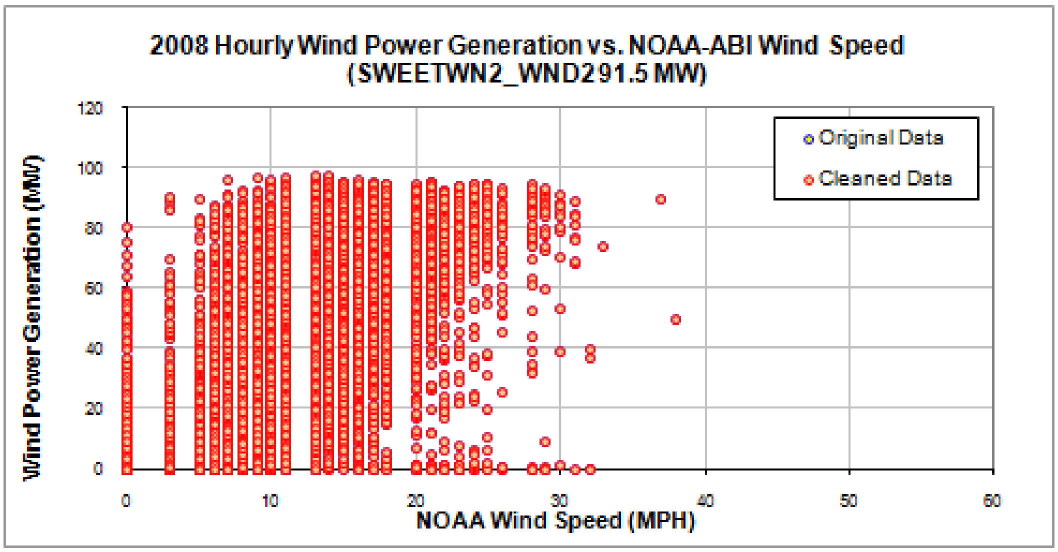


Figure 11-153: SWEETWN2_WND2– Hourly Wind Power vs. NOAA Wind Speed (2008)

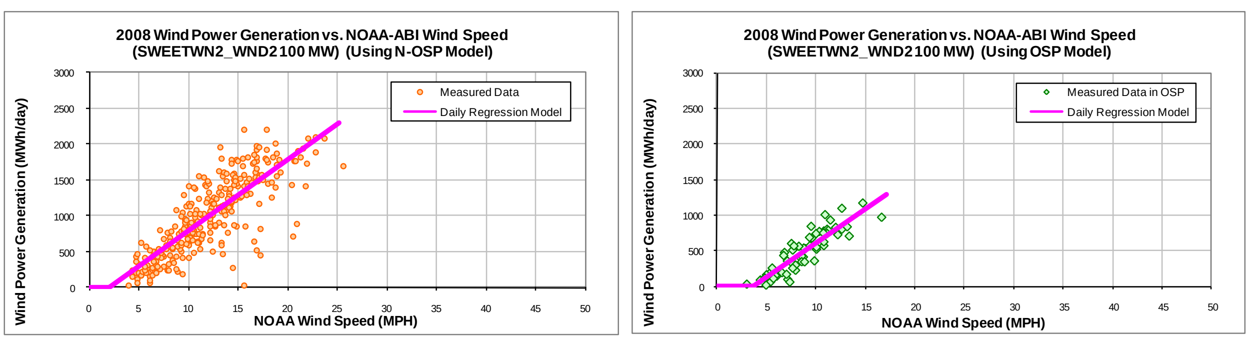


Figure 11-154: SWEETWN2_WND2– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-153: SWEETWN2_WND2– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-203.6023
Left Slope (MWh/mph-day)	99.173
RMSE (MWh/day)	306.9364
R2	0.6694
CV-RMSE	31.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-352.9399
Left Slope (MWh/mph-day)	96.0266
RMSE (MWh/day)	137.1964
R2	0.7918
CV-RMSE	28%

Table 11-154: SWEETWN2_WND2– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	30,437	30,015	1.39%	42%	42%
Feb-08	29	12.36	31,969	29,648	7.26%	46%	42%
Mar-08	31	13.35	30,752	34,720	-12.90%	41%	47%
Apr-08	30	13.87	30,532	35,147	-15.12%	42%	49%
May-08	31	12.79	34,348	33,002	3.92%	46%	44%
Jun-08	30	13.70	32,208	34,648	-7.58%	45%	48%
Jul-08	31	10.58	23,076	23,100	-0.10%	31%	31%
Aug-08	29	7.48	9,725	10,655	-9.57%	14%	15%
Sep-08	30	7.95	13,942	14,865	-6.62%	19%	21%
Oct-08	30	10.71	28,538	25,768	9.71%	40%	36%
Nov-08	30	10.24	27,054	24,354	9.98%	37%	34%
Dec-08	31	12.20	34,503	31,196	9.58%	46%	42%
Total	362	11.46	327,084	327,120	-0.01%	38%	38%
Total in OSP (07/15-09/15)	61	8.77	29,864	29,926	-0.21%	20%	20%

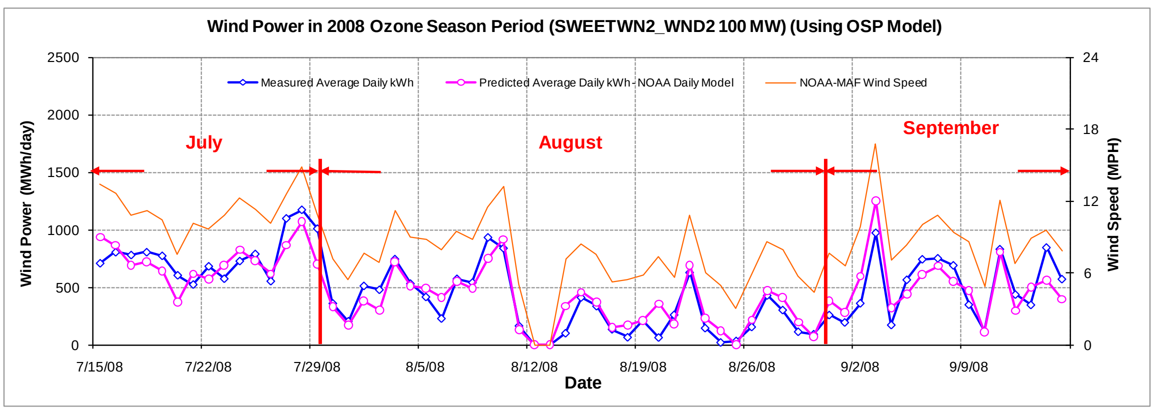


Figure 11-155: SWEETWN2_WND2– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

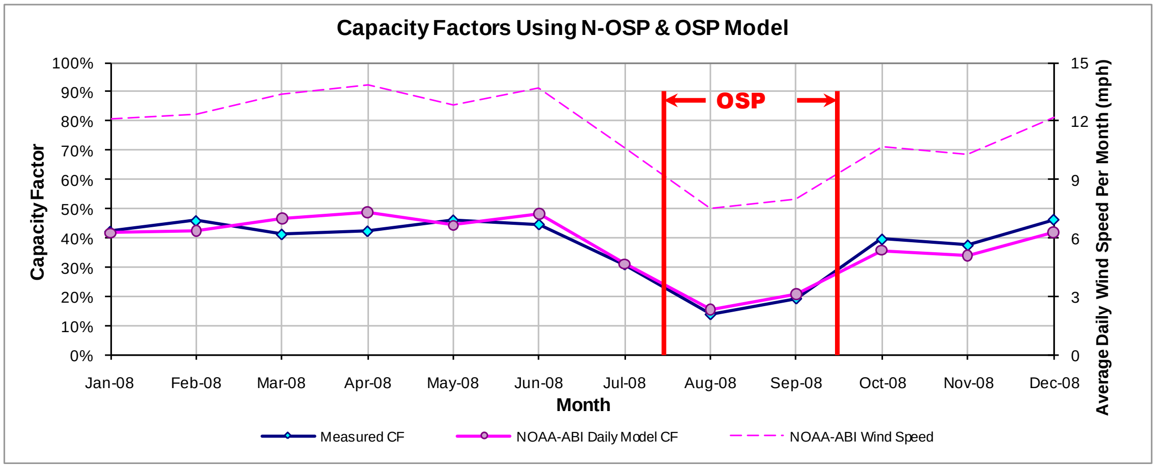


Figure 11-156: SWEETWN2_WND2– Predicted Capacity Factors Using Daily Models (2008)

Table 11-155: SWEETWN2_WND2– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
323,104	330,698	330,734

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
579	490	491

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.38 Sweetwater Wind 2 (SWEETWN2_WND24)

Table 11-156: Site Information for Sweetwater Wind 2 – SWEETWN2_WND24

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN2_WND24	WIND	Abilene	NOLAN	Apr-07	18	DKRW Development	SWEET WIND 24		ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN2_WND24	SWEETWN2_WND24	18

11.38.1 Sweetwater Wind 2 – SWEETWN2_WND24

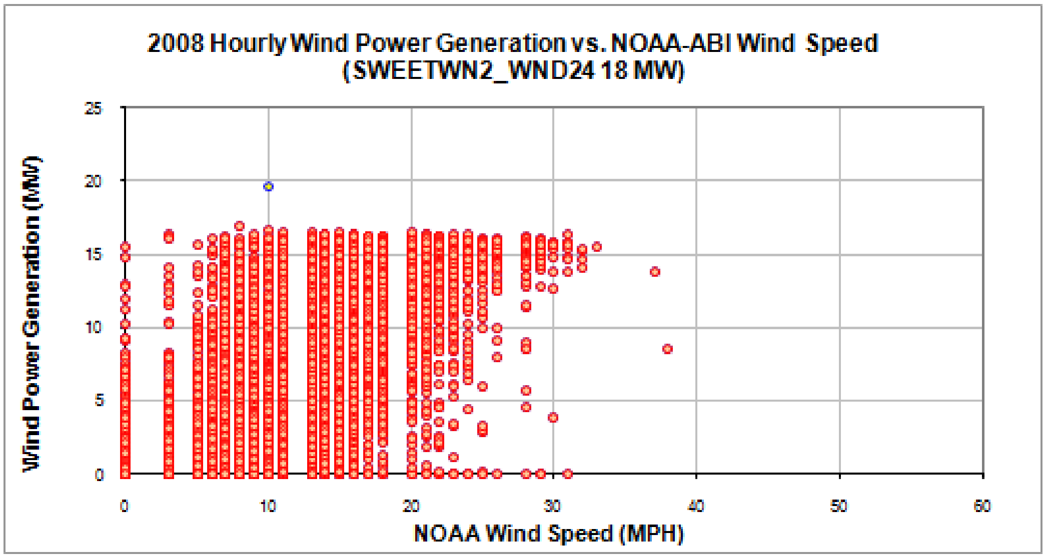


Figure 11-157: SWEETWN2_WND24– Hourly Wind Power vs. NOAA Wind Speed (2008)

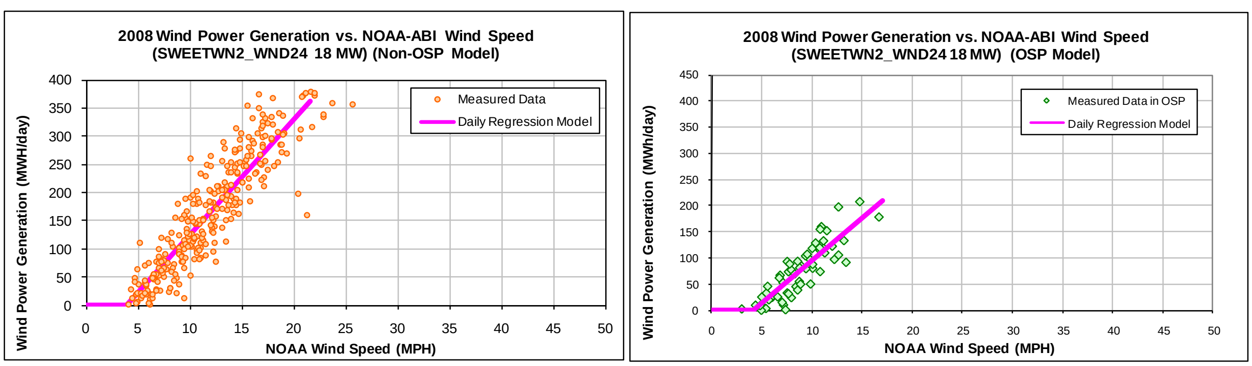


Figure 11-158: SWEETWN2_WND24– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-157: SWEETWN2_WND24– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-79.058
Left Slope (MWh/mph-day)	20.4472
RMSE (MWh/day)	43.1944
R2	0.8134
CV-RMSE	26.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-67.7029
Left Slope (MWh/mph-day)	16.142
RMSE (MWh/day)	25.9525
R2	0.7502
CV-RMSE	35.1%

Table 11-158: SWEETWN2_WND24– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	28	11.80	4,444	4,542	-2.20%	37%	38%
Feb-08	29	12.36	4,630	5,037	-8.80%	37%	40%
Mar-08	30	13.32	5,521	5,798	-5.03%	43%	45%
Apr-08	29	13.84	5,528	5,915	-7.01%	44%	47%
May-08	31	12.79	5,394	5,655	-4.84%	40%	42%
Jun-08	30	13.70	5,924	6,031	-1.81%	46%	47%
Jul-08	31	10.58	3,463	3,667	-5.90%	26%	27%
Aug-08	29	7.48	1,509	1,557	-3.13%	12%	12%
Sep-08	30	7.95	1,854	2,083	-12.35%	14%	16%
Oct-08	30	10.71	4,757	4,200	11.70%	37%	32%
Nov-08	30	10.24	4,468	3,909	12.52%	34%	30%
Dec-08	31	12.20	6,173	5,283	14.43%	46%	39%
Total	358	11.42	53,664	53,677	-0.02%	35%	35%
Total in OSP (07/15-09/15)	61	8.77	4,509	4,528	-0.42%	17%	17%

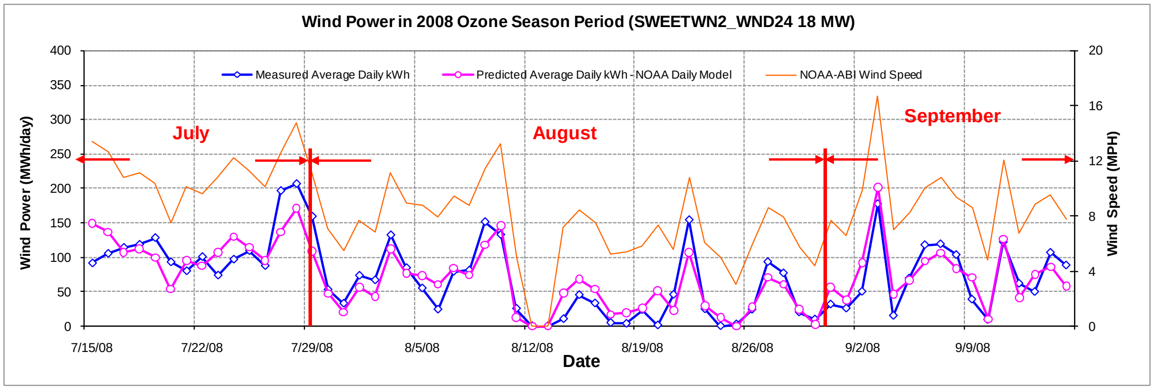


Figure 11-159: SWEETWN2_WND24– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

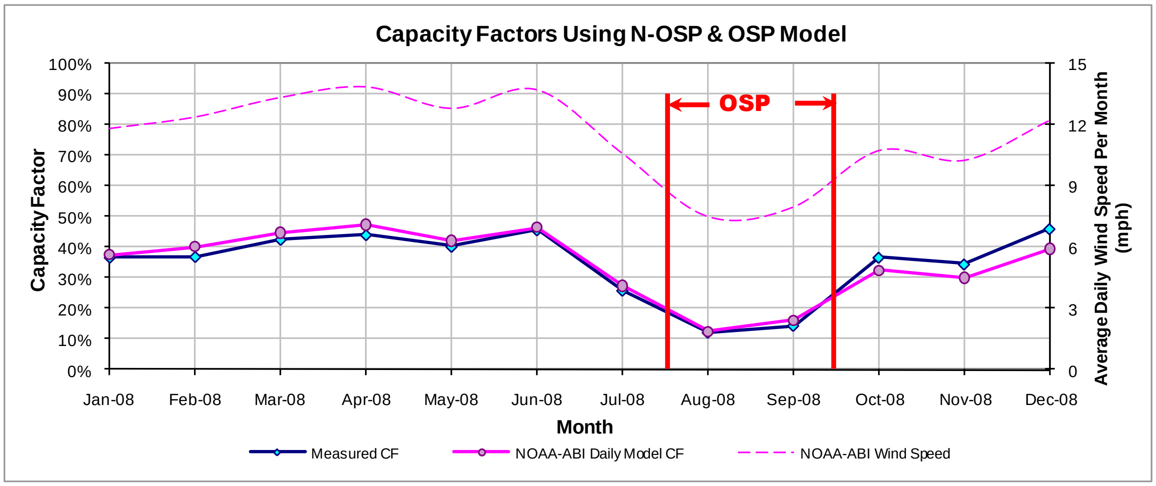


Figure 11-160: SWEETWN2_WND24– Predicted Capacity Factors Using Daily Models (2008)

Table 11-159: SWEETWN2_WND24– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
53,532	54,863	54,877

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
87	74	74

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.39 Sweetwater Wind 3

Table 11-160: Site Information for Sweetwater Wind 3

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN3	WIND	Sweetwater	NOLAN	Dec-05	135	DKRW Development	Sweetwater Wind 3	GE Energy 1.5 MW (90)	ERCOT	TXU	TXU	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN3_WND3	SWEETWN3	135

11.39.1 Sweetwater Wind 3 – SWEETWN3_WND3

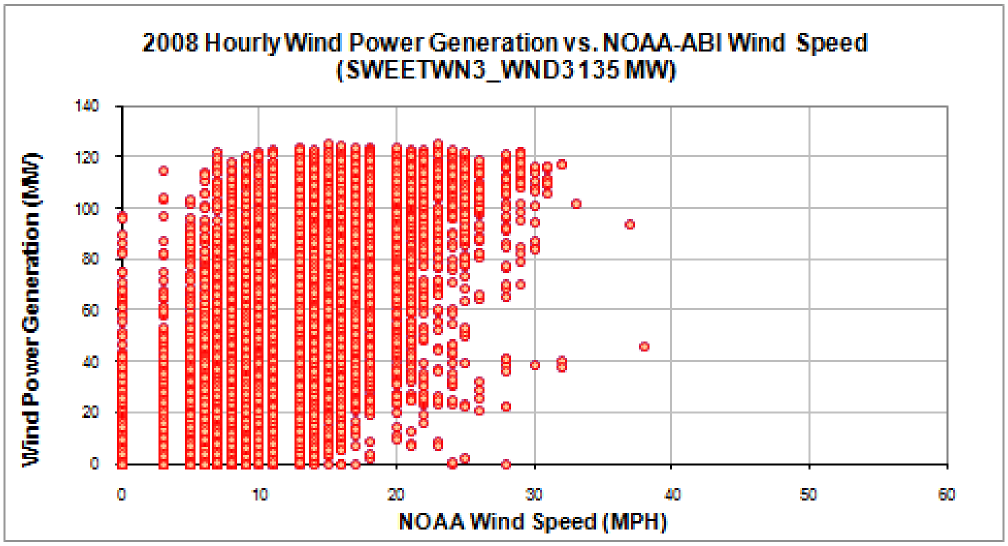


Figure 11-161: SWEETWN3_WND3 – Hourly Wind Power vs. NOAA Wind Speed (2008)

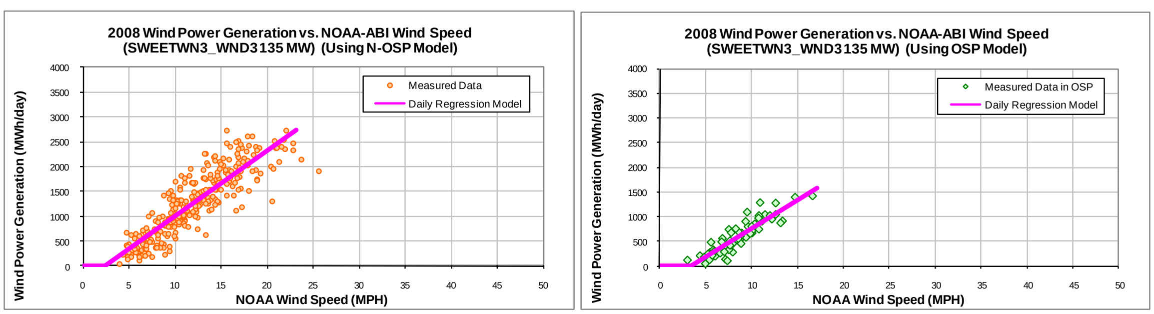


Figure 11-162: SWEETWN3_WND3 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-161: SWEETWN3_WND3 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-323.7099
Left Slope (MWh/mph-day)	132.3089
RMSE (MWh/day)	320.4211
R2	0.7678
CV-RMSE	25.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-387.2555
Left Slope (MWh/mph-day)	114.4205
RMSE (MWh/day)	152.7612
R2	0.8132
CV-RMSE	24.8%

Table 11-162: SWEETWN3_WND3– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH)	Measured Power Generation (MWh)	Predicted Power Generation Using Daily Model (MWh)	Diff.	CV-RMSE	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	40,027	38,482	3.86%	28.62%	41%	40%
Feb-08	29	12.36	39,650	38,044	4.05%	24.06%	42%	40%
Mar-08	31	13.35	46,980	44,707	4.84%	26.79%	47%	45%
Apr-08	30	13.87	41,561	45,328	-9.06%	20.60%	43%	47%
May-08	31	12.79	43,022	42,414	1.41%	18.69%	43%	42%
Jun-08	30	13.70	37,019	44,662	-20.65%	29.28%	38%	46%
Jul-08	31	10.58	27,440	29,030	-5.80%	25.24%	27%	29%
Aug-08	29	7.48	12,464	13,629	-9.35%	34.42%	13%	15%
Sep-08	30	7.95	17,449	18,428	-5.61%	25.81%	18%	19%
Oct-08	30	10.71	36,520	32,815	10.14%	26.03%	38%	34%
Nov-08	30	10.24	33,110	30,929	6.59%	27.58%	34%	32%
Dec-08	31	12.20	43,225	40,005	7.45%	22.81%	43%	40%
Total	362	11.46	418,467	418,473	0.00%	25.67%	36%	36%
Total in OSP (07/15-09/15)	61	616.64	37,655	1,363,502	-3521.00%	25.66%	19%	690%

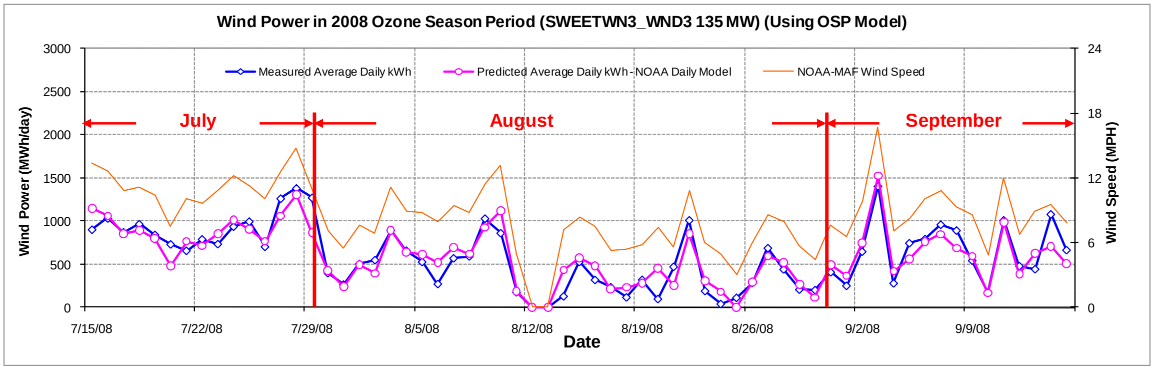


Figure 11-163: SWEETWN3_WND3– Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

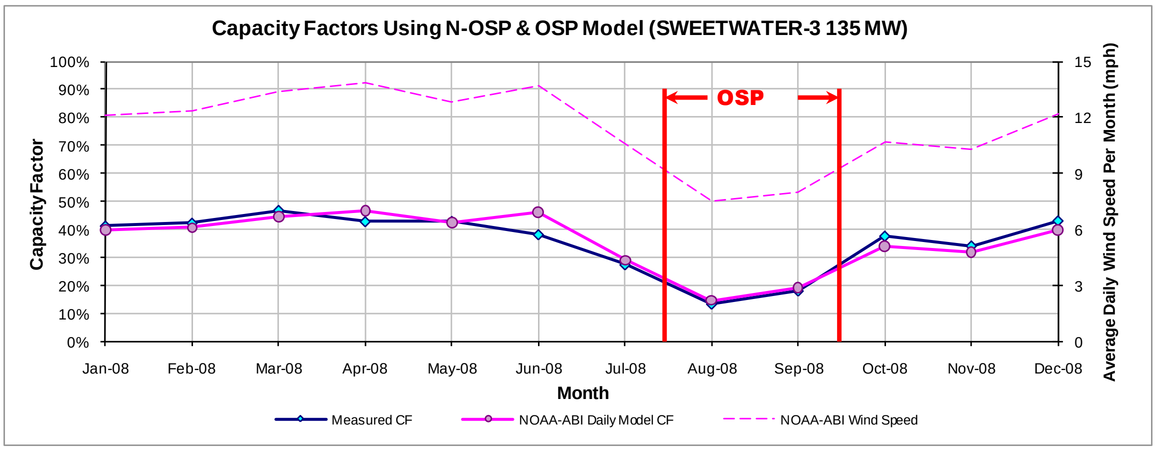


Figure 11-164: SWEETWN3_WND3– Predicted Capacity Factors Using Daily Models (2008)

Table 11-163: SWEETWN3_WND3– Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
412,225	423,097	32,410,255

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
724	617	621

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.40 Sweetwater Wind 4 (SWEETWN4_WND4A)

Table 11-164: Site Information for Sweetwater Wind 4 – SWEETWN4_WND4A

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN4_WND4A	WIND	Abilene	NOLAN	Apr-07	120	DKRW/ Babcock Brown	SWEET WIND 4A	Mitsubishi	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN4_WND4A	SWEETWN4_WND4A	120

11.40.1 Sweetwater Wind 4 – SWEETWN4_WND4A

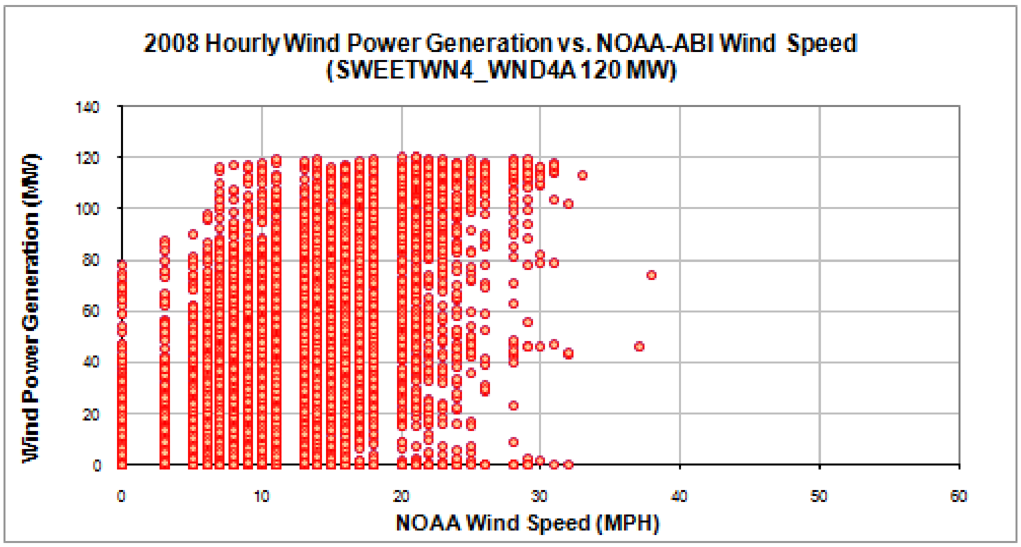


Figure 11-165: SWEETWN4_WND4A– Hourly Wind Power vs. NOAA Wind Speed (2008)

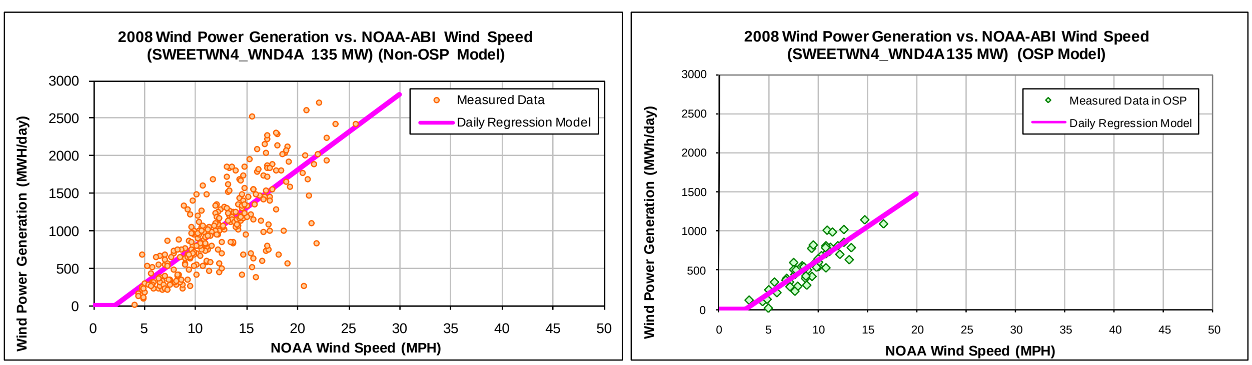


Figure 11-166: SWEETWN4_WND4A– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-165: SWEETWN4_WND4A– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-216.5044
Left Slope (MWh/mph-day)	101.1519
RMSE (MWh/day)	360.5473
R2	0.597
CV-RMSE	35.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-234.2265
Left Slope (MWh/mph-day)	85.8843
RMSE (MWh/day)	124.3484
R2	0.7853
CV-RMSE	22.2%

Table 11-166: SWEETWN4_WND4A– Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	12.25	32,813	29,664	9.60%	35%	32%
Feb-08	28	12.53	31,581	29,438	6.78%	35%	32%
Mar-08	30	13.59	29,988	34,745	-15.86%	31%	36%
Apr-08	30	13.87	29,221	35,583	-21.77%	30%	37%
May-08	30	13.01	30,916	32,984	-6.69%	32%	34%
Jun-08	27	14.49	31,817	33,730	-6.01%	36%	39%
Jul-08	30	10.75	21,445	23,156	-7.98%	22%	24%
Aug-08	22	7.87	9,154	9,723	-6.21%	13%	14%
Sep-08	26	8.21	12,516	13,842	-10.59%	15%	16%
Oct-08	29	10.90	29,609	25,698	13.21%	32%	27%
Nov-08	28	10.52	27,037	23,739	12.20%	30%	26%
Dec-08	31	12.20	37,905	31,545	16.78%	38%	31%
Total	340	11.79	324,001	323,847	0.05%	29%	29%
Total in OSP (07/15-09/15)	51	9.26	28,630	28,628	0.01%	17%	17%

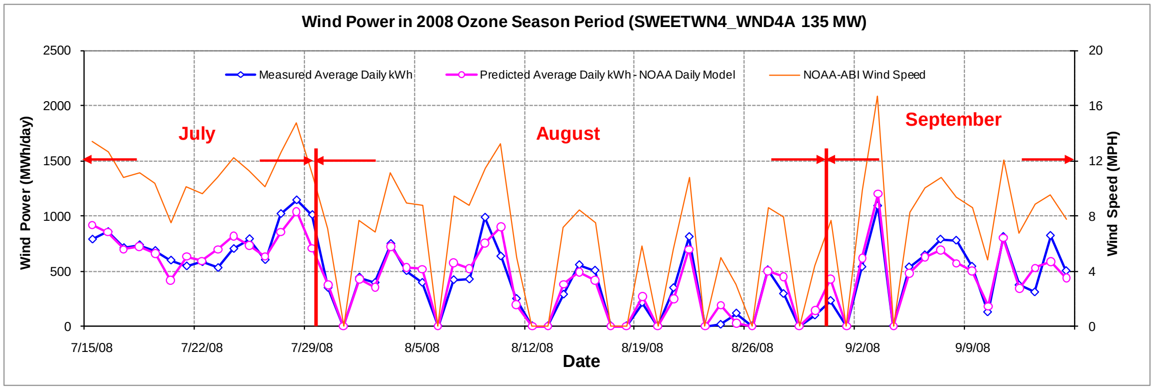


Figure 11-167: SWEETWN4_WND4A – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

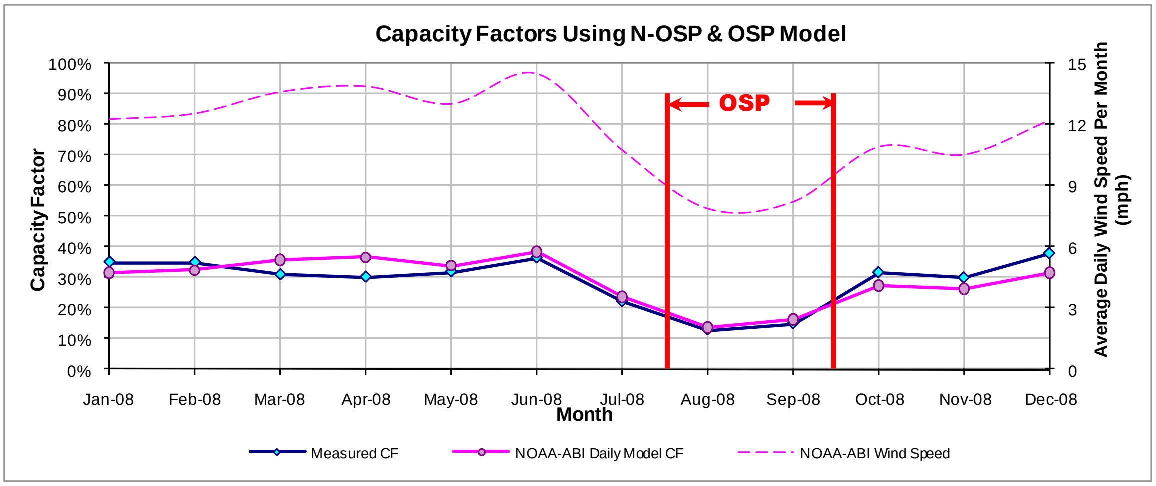


Figure 11-168: SWEETWN4_WND4A – Predicted Capacity Factors Using Daily Models (2008)

Table 11-167: SWEETWN4_WND4A – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
327,428	348,778	348,611

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
600	561	561

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.41 Sweetwater Wind 4 (SWEETWN4_WND4B)

Table 11-168: Site Information for Sweetwater Wind 4 – SWEETWN4_WND4B

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWN4_WND4B	WIND	Abilene	NOLAN	Apr-07	105.8	DKRW/ Babcock Brown	SWEET WIND 4B	Siemens	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWN4_WND4B	SWEETWN4_WND4B	105.8

11.41.1 Sweetwater Wind 4 – SWEETWN4_WND4B

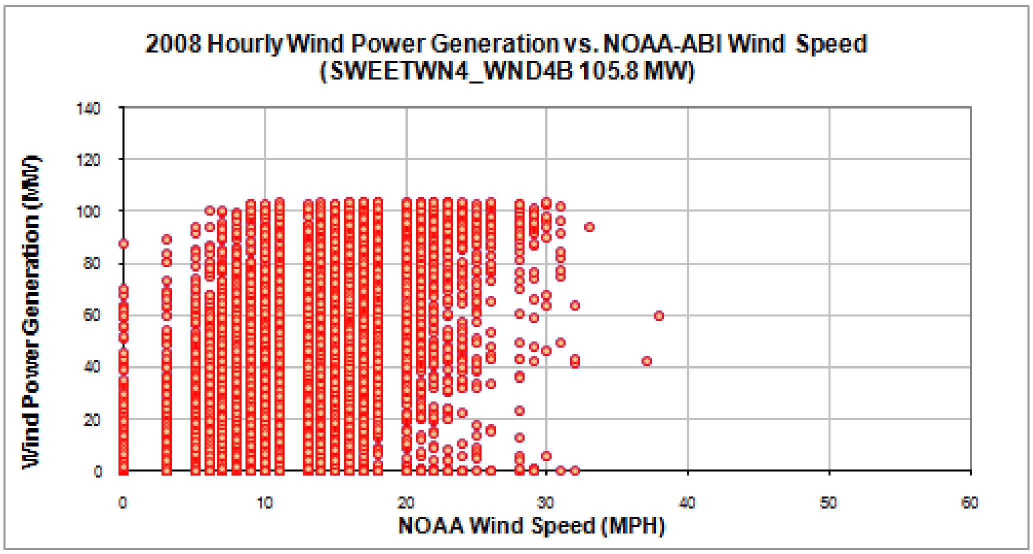


Figure 11-169: SWEETWN4_WND4B – Hourly Wind Power vs. NOAA Wind Speed (2008)

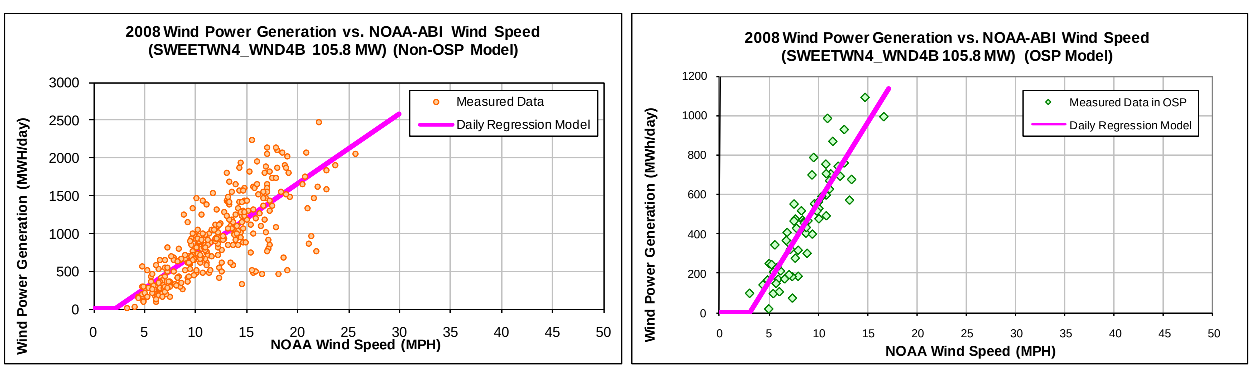


Figure 11-170: SWEETWN4_WND4B – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-169: SWEETWN4_WND4B – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-188.6501
Left Slope (MWh/mph-day)	92.5323
RMSE (MWh/day)	325.2229
R2	0.6123
CV-RMSE	35.3%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-250.1692
Left Slope (MWh/mph-day)	80.918
RMSE (MWh/day)	120.0114
R2	0.7766
CV-RMSE	26.4%

Table 11-170: SWEETWN4_WND4B – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	12.25	30,608	27,409	10.45%	42%	37%
Feb-08	28	12.47	29,333	27,018	7.89%	41%	38%
Mar-08	30	13.11	28,058	30,720	-9.49%	37%	40%
Apr-08	30	13.87	26,136	32,833	-25.62%	34%	43%
May-08	31	12.79	29,212	30,833	-5.55%	37%	39%
Jun-08	30	13.70	27,428	32,367	-18.01%	36%	42%
Jul-08	30	10.64	19,544	20,724	-6.04%	26%	27%
Aug-08	31	7.43	10,213	10,895	-6.67%	13%	14%
Sep-08	30	7.95	12,451	13,887	-11.53%	16%	18%
Oct-08	31	10.48	27,136	24,202	10.81%	34%	31%
Nov-08	30	10.24	26,884	22,763	15.33%	35%	30%
Dec-08	31	12.20	35,816	29,148	18.62%	46%	37%
Total	361	11.41	302,819	302,799	0.01%	33%	33%
Total in OSP (07/15-09/15)	63	8.71	28,641	28,645	-0.01%	18%	18%

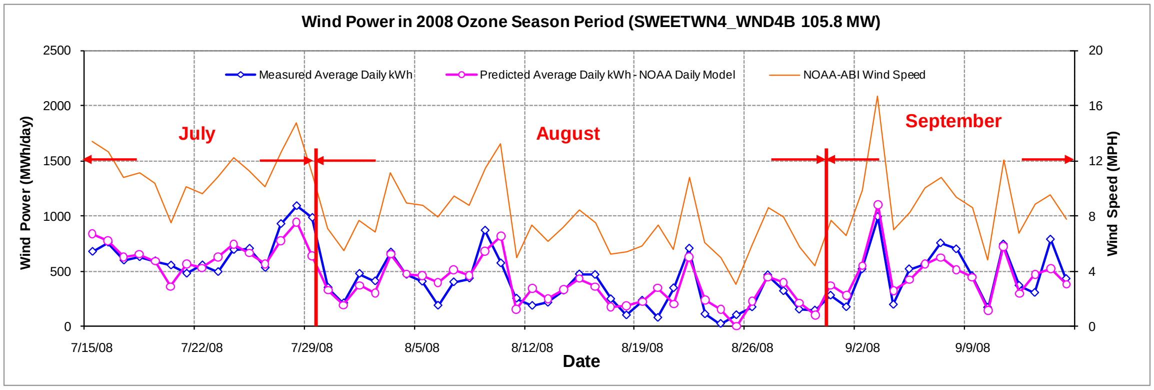


Figure 11-171: SWEETWN4_WND4B – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

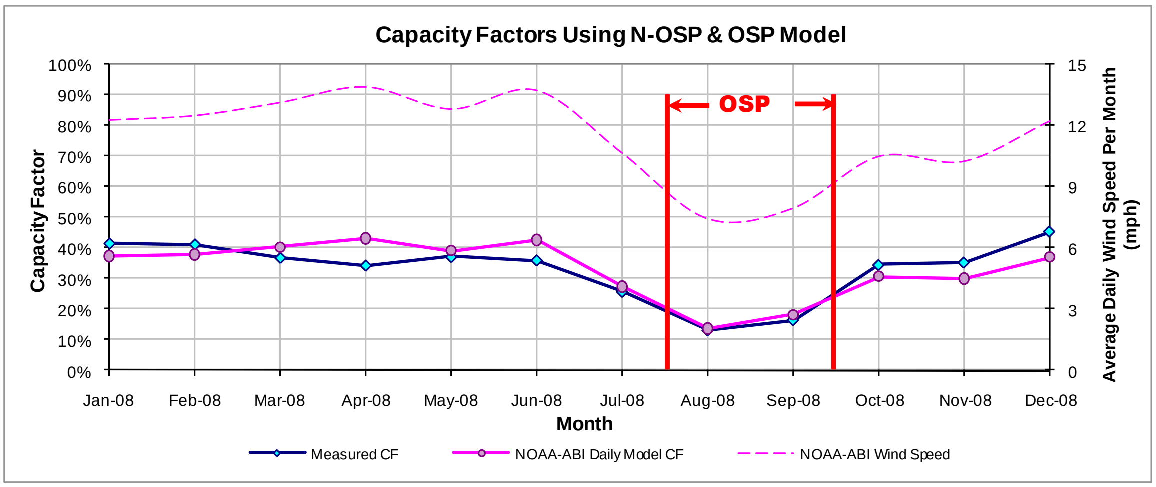


Figure 11-172: SWEETWN4_WND4B – Predicted Capacity Factors Using Daily Models (2008)

Table 11-171: SWEETWN4_WND4B – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
301,544	307,013	306,993

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
535	455	455

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown in Table 3-1.

11.42 Sweetwater Wind 5

Table 11-172: Site Information for Sweetwater Wind 5

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
SWEETWND4_WND 5	WIND	Sweetwater	Nolan	Dec-07	80.5	DKRW/BabockBrown	Sweetwater Wind 5	Siemens	ERCOT		LCRA	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
SWEETWND4_WND 5	SWEETWND4_WND 5	80.5

11.42.1 Sweetwater Wind 5 – SWEETWN4_WND5

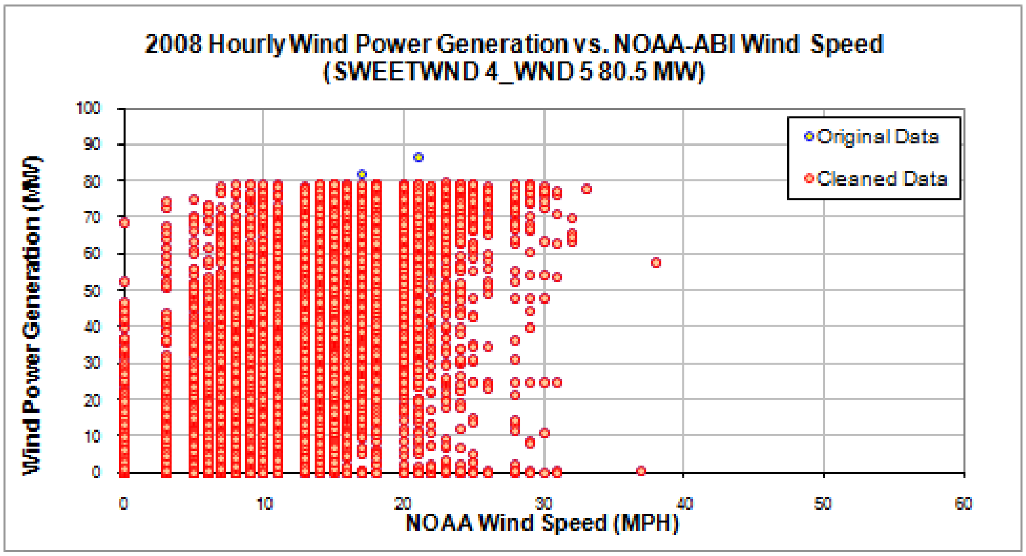


Figure 11-173: SWEETWN4_WND5– Hourly Wind Power vs. NOAA Wind Speed (2008)

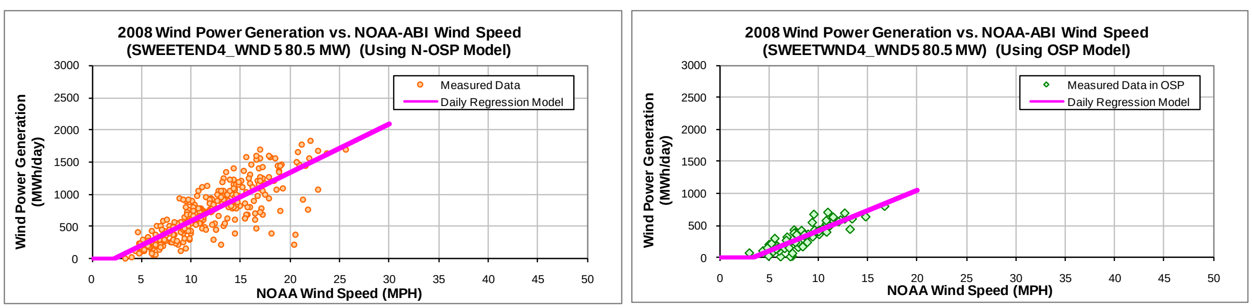


Figure 11-174: SWEETWN4_WND5– Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-173: SWEETWN4_WND5– Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-165.8198
Left Slope (MWh/mph-day)	74.9447
RMSE (MWh/day)	238.1
R2	0.6588
CV-RMSE	32.4%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-205.326
Left Slope (MWh/mph-day)	62.2236
RMSE (MWh/day)	103.9434
R2	0.7326
CV-RMSE	30.9%

Table 11-174: SWEETWN4_WND5 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.35	22,284	22,800	-2.32%	38%	39%
Feb-08	28	12.53	22,273	21,660	2.75%	41%	40%
Mar-08	31	13.35	21,629	25,867	-19.60%	36%	43%
Apr-08	30	13.87	24,216	26,202	-8.20%	42%	45%
May-08	31	12.79	25,394	24,569	3.25%	42%	41%
Jun-08	30	13.70	24,511	25,825	-5.36%	42%	45%
Jul-08	31	10.58	15,738	16,459	-4.58%	26%	27%
Aug-08	31	7.43	7,131	7,989	-12.03%	12%	13%
Sep-08	30	7.95	9,623	10,557	-9.71%	17%	18%
Oct-08	31	10.48	21,690	19,198	11.49%	36%	32%
Nov-08	30	10.24	20,265	18,045	10.95%	35%	31%
Dec-08	31	12.20	27,625	23,204	16.00%	46%	39%
Total	364	11.44	242,378	242,374	0.00%	34%	34%
Total in OSP (07/15-09/15)	63	8.71	21,208	21,224	-0.08%	17%	17%

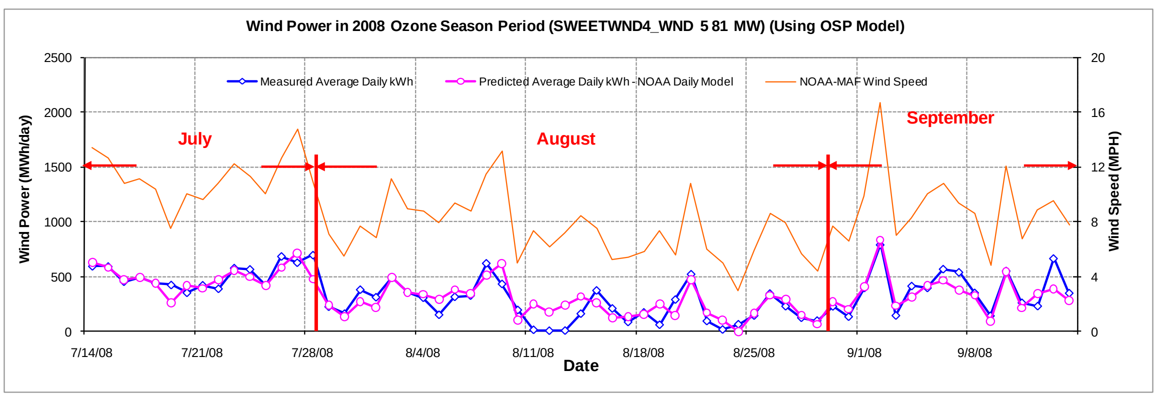


Figure 11-175: SWEETWN4_WND5 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

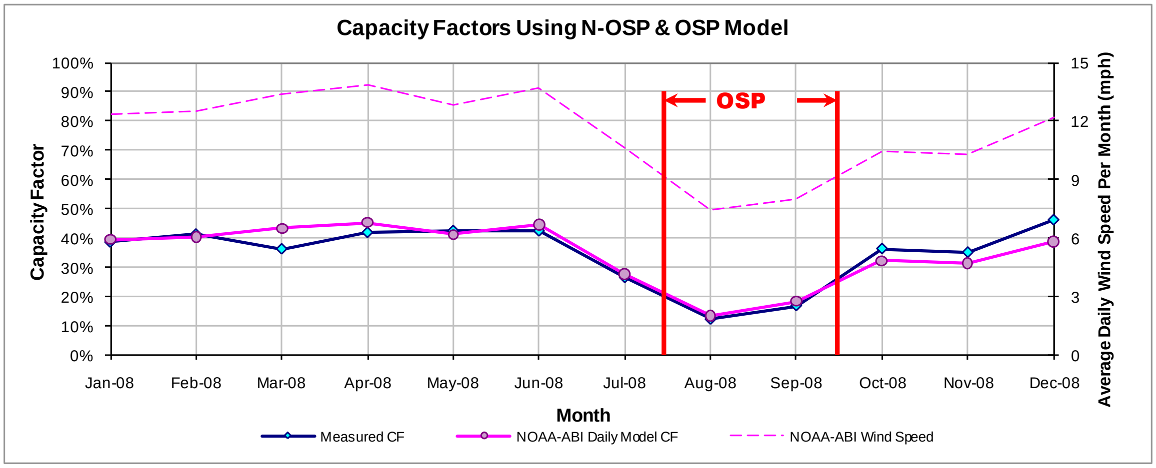


Figure 11-176: SWEETWN4_WND5 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-175: SWEETWN4_WND5 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
238,098	243,709	243,706

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
399	337	339

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.43 Roscoe Wind Farm 1

Table 11-176: Site Information for Roscoe Wind Farm 1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
TKWSW1_ROSCOE	WIND		Scurry	Jan-08	220	Airtricity	Roscoe Wind Farm 1	Mitsubishi	ERCOT		ONCOR	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
TKWSW1_ROSCOE	TKWSW1_ROSCOE	220

11.43.1 Roscoe Wind Farm 1 – TKWSW1_ROSCOE

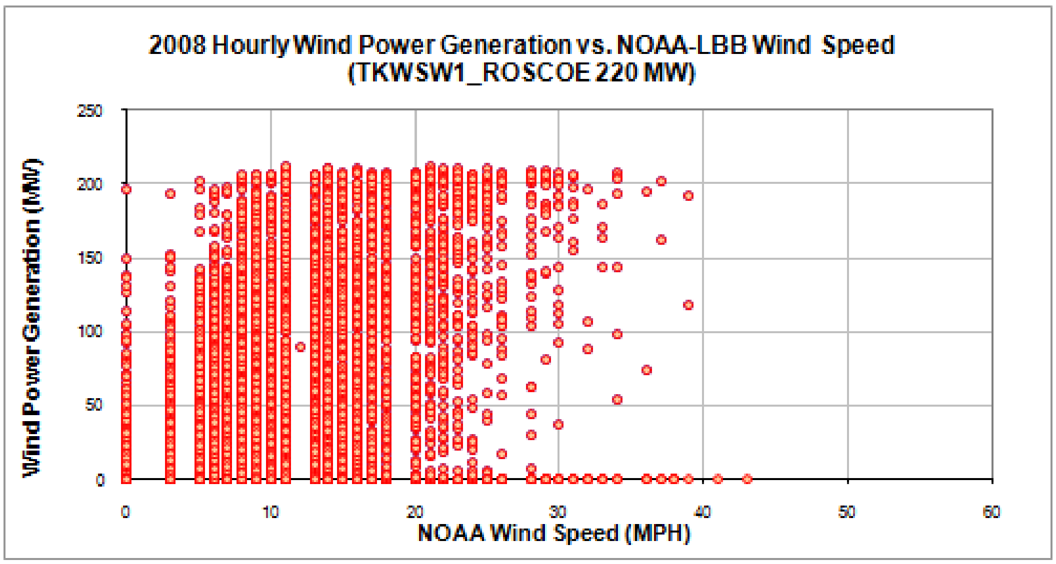


Figure 11-177: TKWSW1_ROSCOE – Hourly Wind Power vs. NOAA Wind Speed (2008)

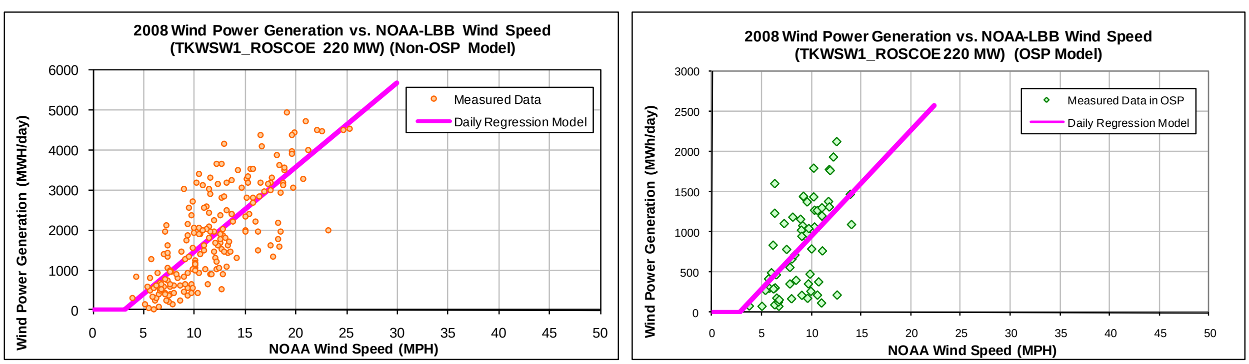


Figure 11-178: TKWSW1_ROSCOE – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-177: TKWSW1_ROSCOE – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-656.2073
Left Slope (MWh/mph-day)	211.7831
RMSE (MWh/day)	758.8407
R2	0.6079
CV-RMSE	40.6%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-367.9079
Left Slope (MWh/mph-day)	132.2036
RMSE (MWh/day)	470.2658
R2	0.3028
CV-RMSE	57.3%

Table 11-178: TKWSW1_ROSCOE – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08							
Feb-08							
Mar-08							
Apr-08	16	15.14	42,307	40,787	3.59%	50%	48%
May-08	31	12.95	67,346	64,697	3.93%	41%	40%
Jun-08	30	14.14	62,294	70,145	-12.60%	39%	44%
Jul-08	31	10.53	37,038	40,727	-9.96%	23%	25%
Aug-08	31	8.71	17,494	24,301	-38.91%	11%	15%
Sep-08	30	7.92	22,203	24,328	-9.57%	14%	15%
Oct-08	30	10.74	46,616	48,543	-4.13%	29%	31%
Nov-08	30	10.60	50,104	47,652	4.89%	32%	30%
Dec-08	31	12.08	74,787	58,979	21.14%	46%	36%
Total	260	11.22	420,188	420,160	0.01%	31%	31%
Total in OSP (07/15-09/15)	63	8.99	51,665	51,663	0.00%	16%	16%

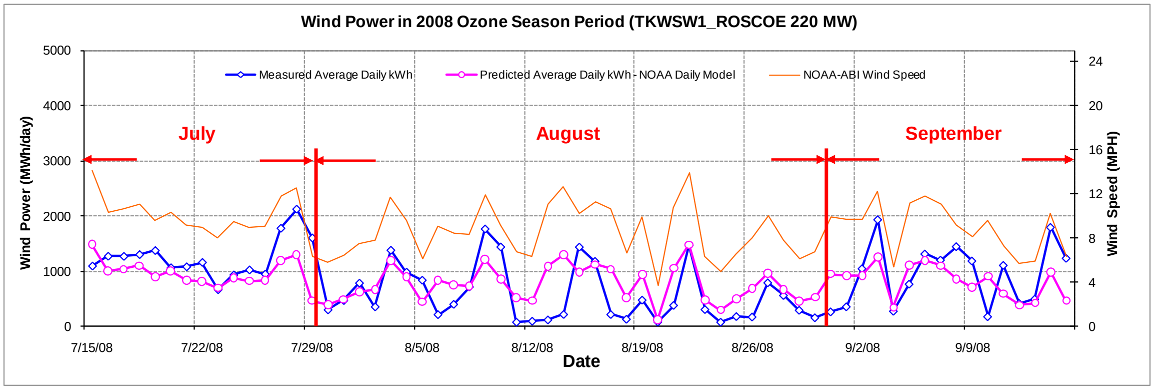


Figure 11-179: TKWSW1_ROSCOE – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

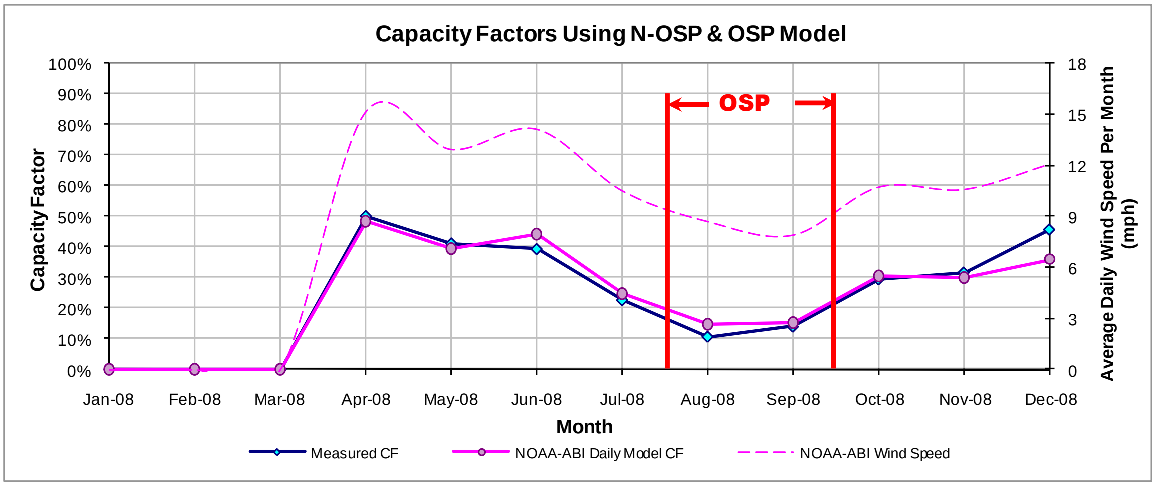


Figure 11-180: TKWSW1_ROSCOE – Predicted Capacity Factors Using Daily Models (2008)

Table 11-179: TKWSW1_ROSCOE – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
659,296	591,496	591,455

1999 (Apr-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Apr-Dec) Measured MWh/yr	2008 (Apr-Dec) Predicted MWh/yr (2008 Daily Model)
422,591	421,804	421,776

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2007 Daily Model)
934	820	820

Note: The 2008 (Apr-Dec) Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 261 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.44 Champion Wind Farm

Table 11-180: Site Information for Champion Wind Farm

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
TKWSW_CHAMPION	WIND		Scurry	Jan-08	126.5	Airtricity	Champion Wind Farm	Siemens	ERCOT		ONCOR	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
TKWSW_CHAMPION	TKWSW_CHAMPION	126.5

11.44.1 Champion Wind Farm – TKWSW_CHAMPION

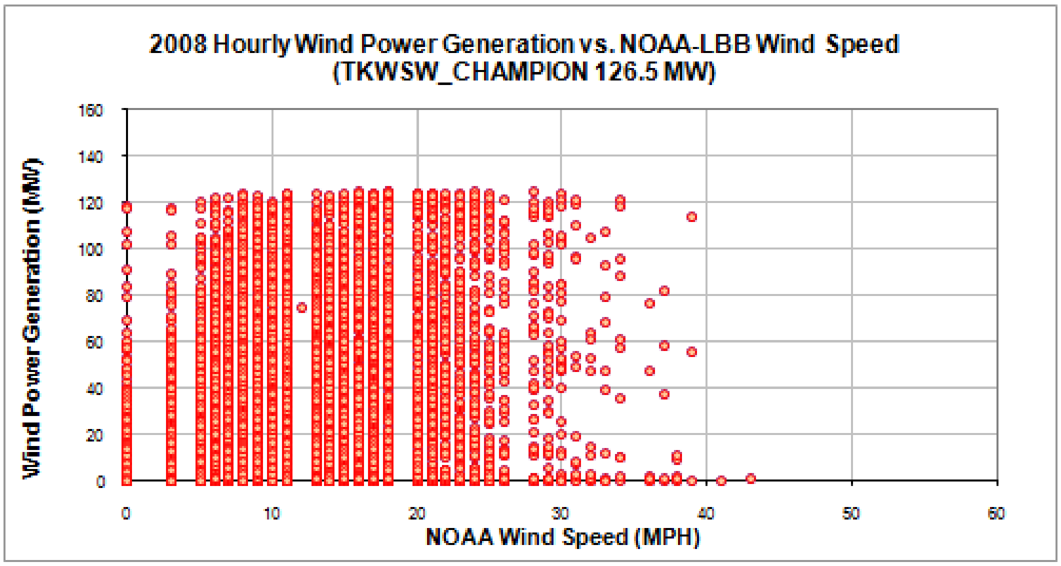


Figure 11-181: TKWSW_CHAMPION – Hourly Wind Power vs. NOAA Wind Speed (2008)

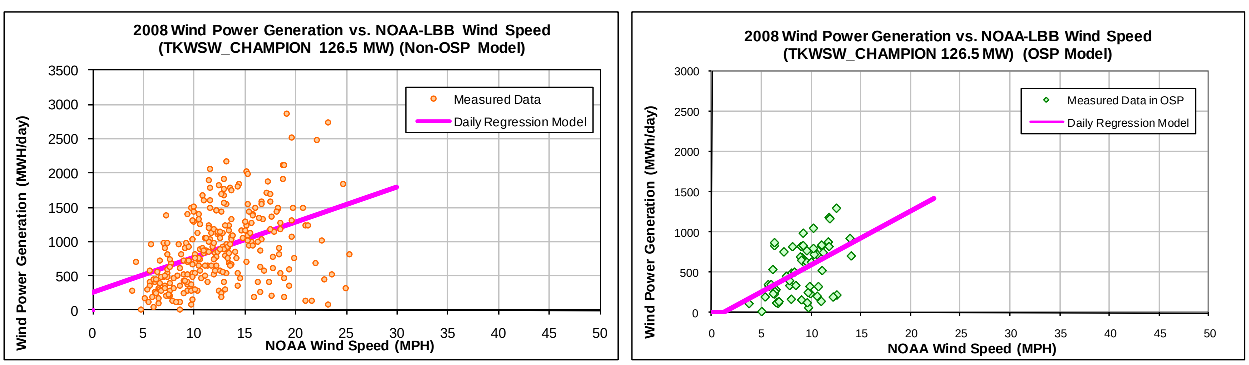


Figure 11-182: TKWSW_CHAMPION – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-181: TKWSW_CHAMPION – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	259.4824
Left Slope (MWh/mph-day)	51.0217
RMSE (MWh/day)	491.9056
R2	0.1756
CV-RMSE	54.9%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-79.8816
Left Slope (MWh/mph-day)	67.0236
RMSE (MWh/day)	282.2789
R2	0.2366
CV-RMSE	54%

Table 11-182: TKWSW_CHAMPION – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	5	17.53	829	5,768	-595.55%	5%	38%
Feb-08	29	12.61	20,231	26,186	-29.43%	23%	30%
Mar-08	31	14.90	25,938	31,616	-21.89%	28%	34%
Apr-08	30	14.34	32,805	29,732	9.37%	36%	33%
May-08	31	12.95	29,554	28,531	3.46%	31%	30%
Jun-08	30	14.14	32,289	29,426	8.87%	35%	32%
Jul-08	31	10.53	23,496	21,524	8.39%	25%	23%
Aug-08	31	8.71	12,357	15,626	-26.45%	13%	17%
Sep-08	30	7.92	13,911	16,951	-21.86%	15%	19%
Oct-08	31	10.54	28,615	24,722	13.60%	30%	26%
Nov-08	30	10.60	27,273	24,007	11.97%	30%	26%
Dec-08	31	12.08	33,957	27,154	20.03%	36%	29%
Total	340	11.84	281,254	281,243	0.00%	27%	27%
Total in OSP (07/15-09/15)	63	8.99	32,911	32,910	0.00%	17%	17%

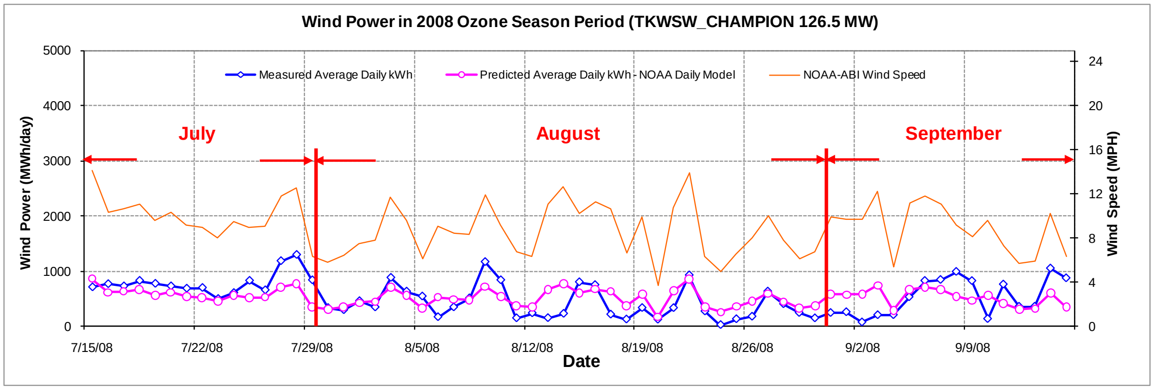


Figure 11-183: TKWSW_CHAMPION – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

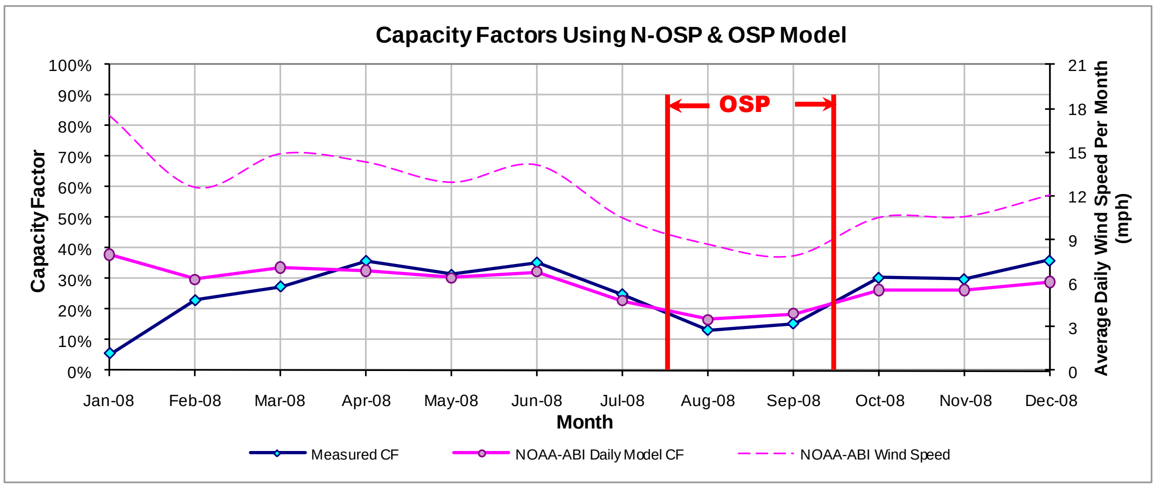


Figure 11-184: TKWSW_CHAMPION – Predicted Capacity Factors Using Daily Models (2008)

Table 11-183: TKWSW_CHAMPION – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
307,315	302,762	302,750

1999 (Jan-Dec) Estimated MWh/yr (2008 Daily Model)	2008 (Jan-Dec) Measured MWh/yr	2008 (Jan-Dec) Predicted MWh/yr (2008 Daily Model)
286,696	282,909	282,897

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2007 Daily Model)
580	522	522

Note: The 2008 (1/23-12/21) Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 342 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.45 Trent Mesa

Table 11-184: Site Information for Trent Mesa

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
TRENT	WIND	Trent Mesa	NOLAN	Nov-01	150	AEP	Trent Mesa	Enron 1500 (100)	ERCOT	TXU	TXU	ABI	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
TRENT_TRENT	TRENT	150

11.45.1 Trent Mesa – TRENT_TRENT

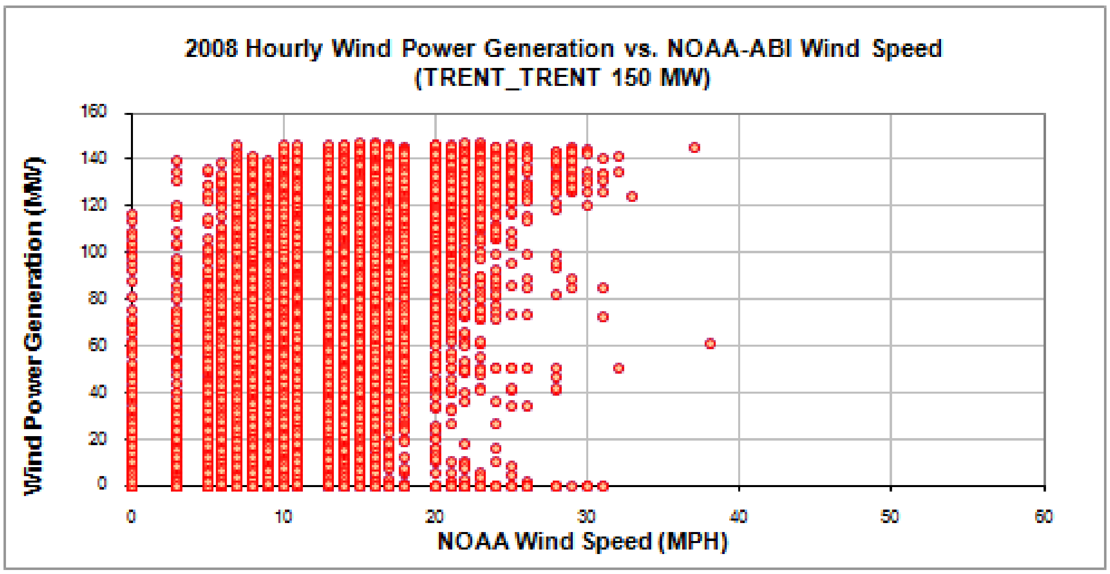


Figure 11-185: TRENT_TRENT – Hourly Wind Power vs. NOAA Wind Speed (2008)

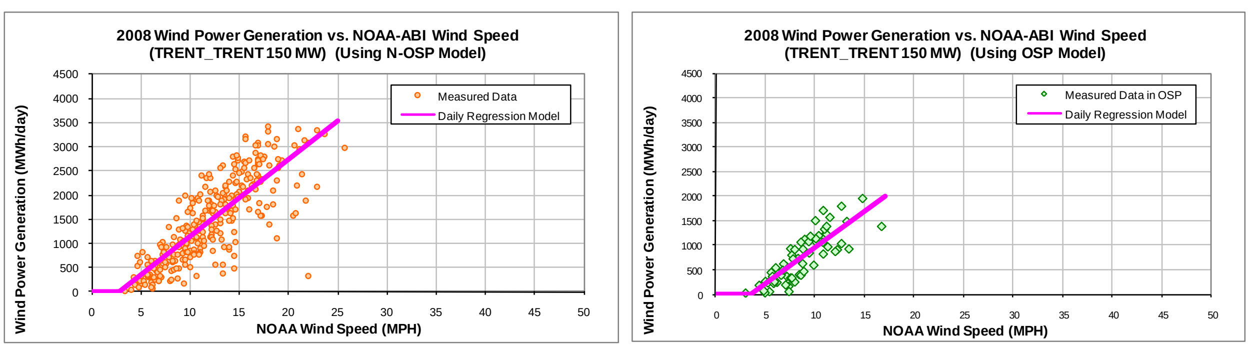


Figure 11-186: TRENT_TRENT – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-185: TRENT_TRENT – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-451.653
Left Slope (MWh/mph-day)	159.5148
RMSE (MWh/day)	503.7416
R2	0.6625
CV-RMSE	34.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-532.5062
Left Slope (MWh/mph-day)	147.7155
RMSE (MWh/day)	274.5042
R2	0.6889
CV-RMSE	36.4%

Table 11-186: TRENT_TRENT – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	30	12.14	47,039	44,553	5.28%	44%	41%
Feb-08	29	12.36	43,892	44,087	-0.44%	42%	42%
Mar-08	31	13.35	54,013	51,997	3.73%	48%	47%
Apr-08	30	13.87	50,906	52,807	-3.73%	47%	49%
May-08	31	12.79	47,995	49,233	-2.58%	43%	44%
Jun-08	30	13.70	48,486	52,004	-7.26%	45%	48%
Jul-08	31	10.58	34,275	34,794	-1.51%	31%	31%
Aug-08	31	7.43	17,894	17,614	1.56%	16%	16%
Sep-08	30	7.95	19,193	21,651	-12.81%	18%	20%
Oct-08	31	10.48	39,971	37,801	5.43%	36%	34%
Nov-08	30	10.24	37,569	35,447	5.65%	35%	33%
Dec-08	31	12.20	47,043	46,329	1.52%	42%	42%
Total	365	11.42	488,275	488,317	-0.01%	37%	37%
Total in OSP (07/15-09/15)	63	8.71	47,507	47,590	-0.18%	21%	21%

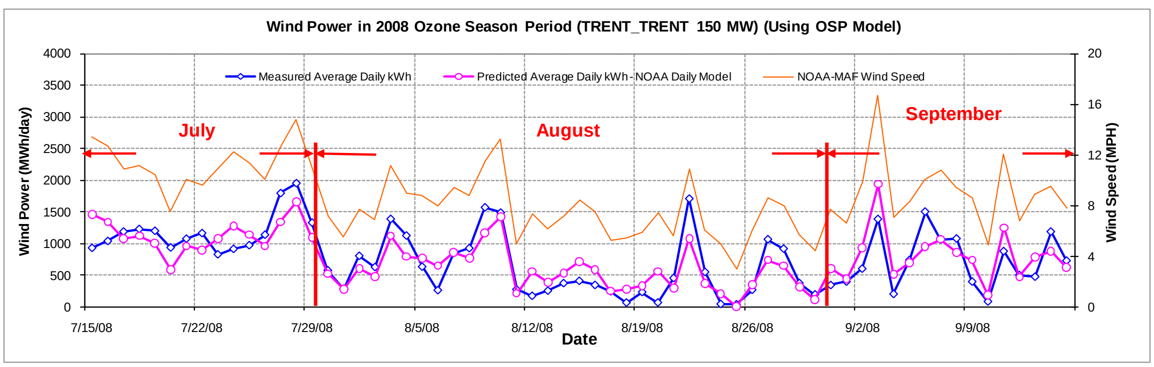


Figure 11-187: TRENT_TRENT – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

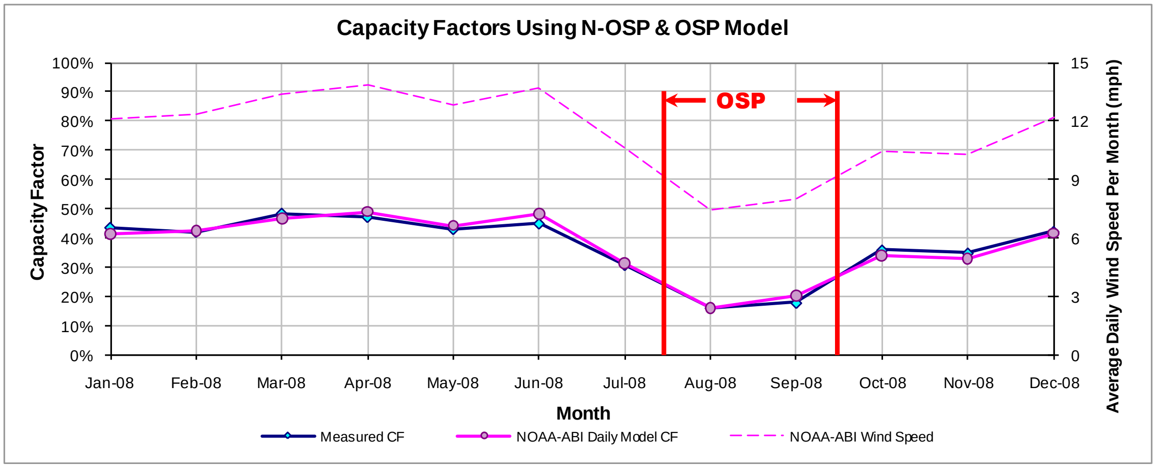


Figure 11-188: TRENT_TRENT – Predicted Capacity Factors Using Daily Models (2008)

Table 11-187: TRENT_TRENT – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
480,340	489,613	489,655

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
902	754	755

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.46 Whirlwind

Table 11-188: Site Information for Whirlwind

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
WEC_WECG1	WIND		Floyd	Dec-07	60	Renewable Energy Systems	Whirlwind	Siemens	ERCOT		AEP	LBB	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
WEC_WECG1	WEC_WECG1	60

11.46.1 Whirlwind – WEC_WECG1

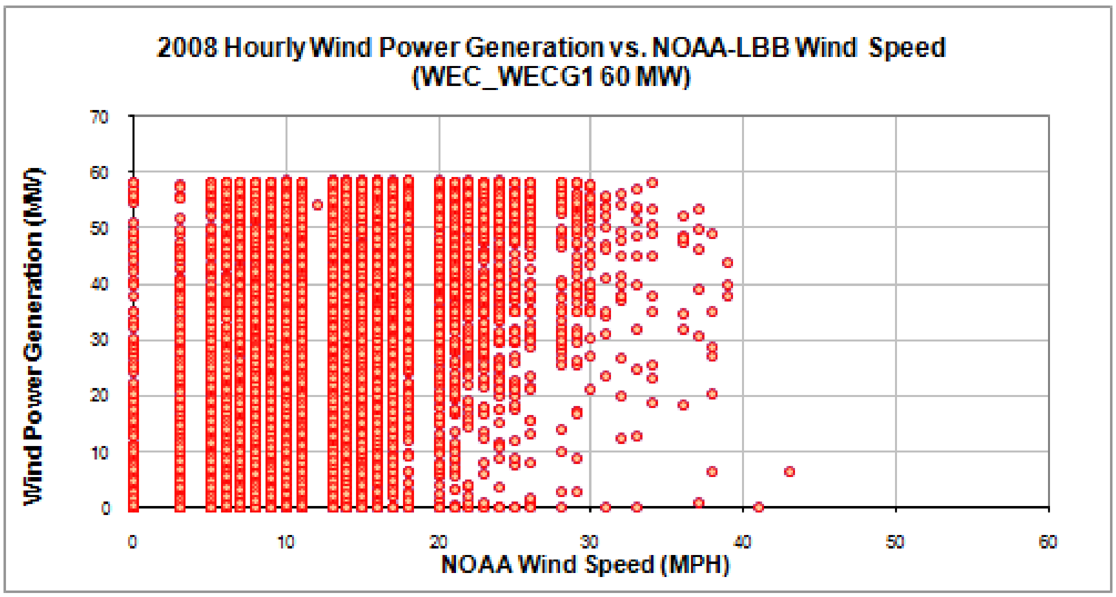


Figure 11-189: WEC_WECG1 – Hourly Wind Power vs. NOAA Wind Speed (2008)

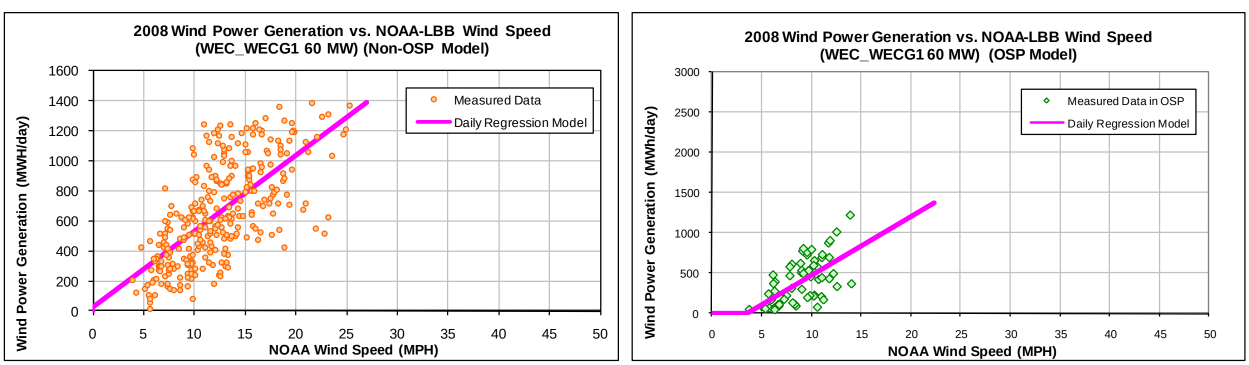


Figure 11-190: WEC_WECG1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-189: WEC_WECG1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	23.4118
Left Slope (MWh/mph-day)	50.6064
RMSE (MWh/day)	241.8056
R2	0.4562
CV-RMSE	37.1%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-255.6496
Left Slope (MWh/mph-day)	73.344
RMSE (MWh/day)	223.5068
R2	0.3718
CV-RMSE	55.4%

Table 11-190: WEC_WECG1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	31	12.74	17,884	20,715	-15.83%	40%	46%
Feb-08	29	12.61	17,865	19,188	-7.41%	43%	46%
Mar-08	31	14.90	22,659	24,106	-6.39%	51%	54%
Apr-08	30	14.34	21,720	22,472	-3.46%	50%	52%
May-08	31	12.95	19,767	21,046	-6.47%	44%	47%
Jun-08	30	14.14	21,467	22,168	-3.26%	50%	51%
Jul-08	31	10.53	18,471	16,190	12.35%	41%	36%
Aug-08	31	8.71	11,301	11,884	-5.16%	25%	27%
Sep-08	30	7.92	11,353	11,574	-1.95%	26%	27%
Oct-08	31	10.54	18,442	17,268	6.37%	41%	39%
Nov-08	30	10.60	19,613	16,793	14.38%	45%	39%
Dec-08	31	12.08	22,553	19,680	12.74%	51%	44%
Total	366	11.84	223,095	223,084	0.01%	42%	42%
Total in OSP (07/15-09/15)	63	8.99	25,415	25,414	0.00%	28%	28%

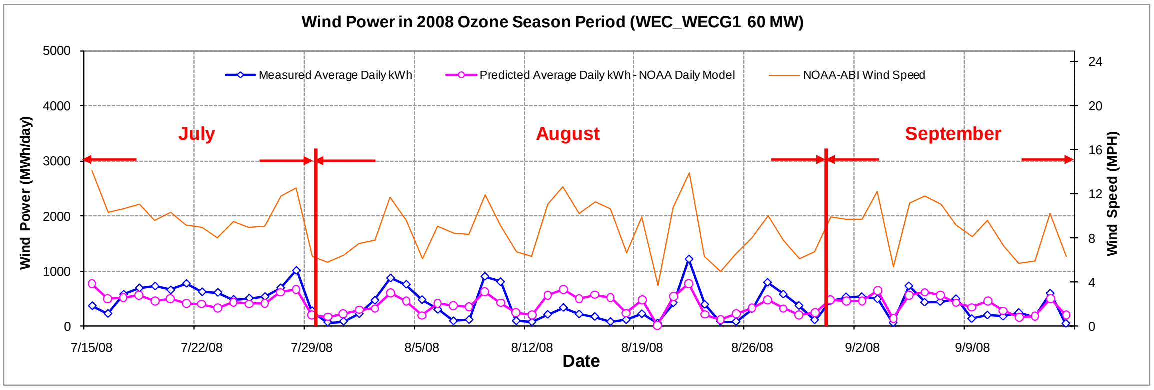


Figure 11-191: WEC_WECG1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

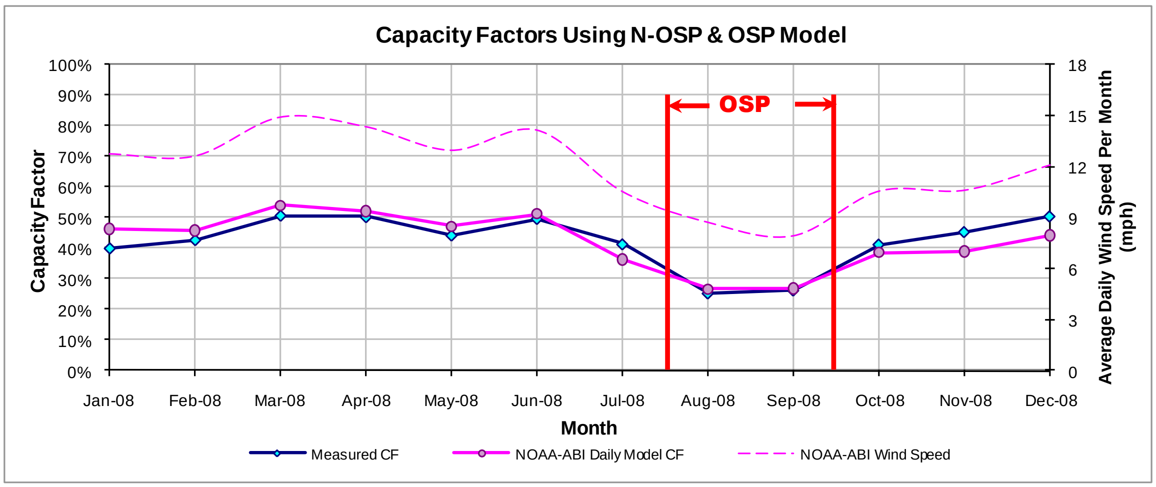


Figure 11-192: WEC_WECG1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-191: WEC_WECG1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr	2008 Predicted MWh/yr (2008 Daily Model)
227,304	223,095	223,084

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day	2008 OSD Predicted MWh/day (2008 Daily Model)
467	403	403

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.47 Woodward Mountain Ranch (WOODWRD1_WOODWRD1)

Table 11-192: Site Information for Woodward Mountain Ranch – WOODWRD1_WOODWRD1

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
WOODWRD1	WIND	McCamey	PECOS	Jul-01	80	FPL/Cielo/TXU	Woodward Mountain Ranch	Vestas V-47 (121)	ERCOT	AEP-West	WTU	FST	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
WOODWRD1_WOODWRD1	WOODWRD1	80

11.47.1 Woodward Mountain Ranch – WOODWRD1_WOODWRD1

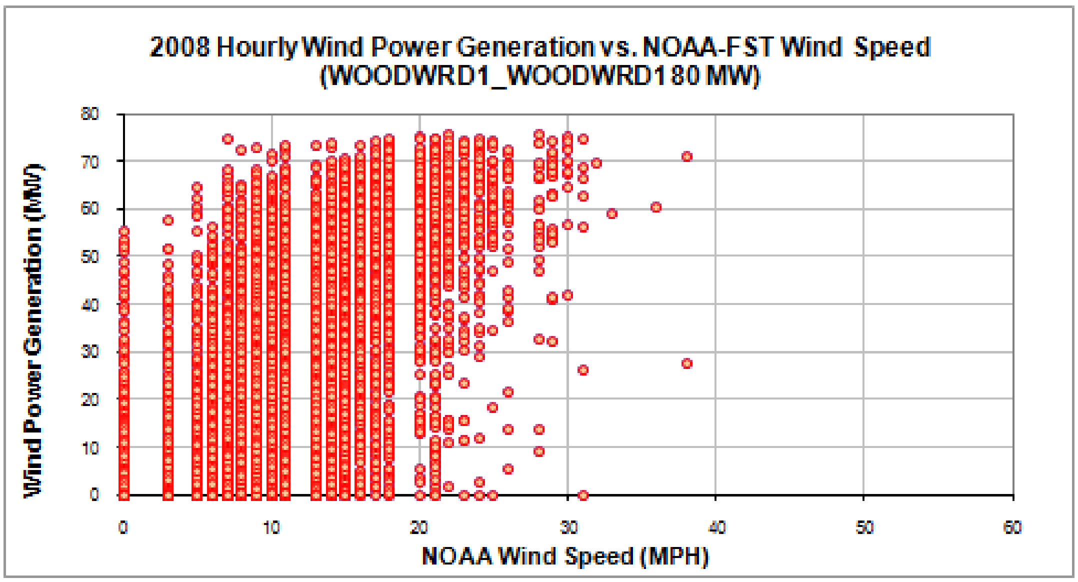
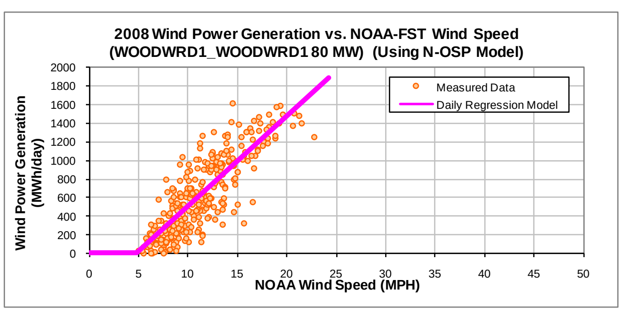


Figure 11-193: WOODWRD1_WOODWRD1 – Hourly Wind Power vs. NOAA Wind Speed (2008)



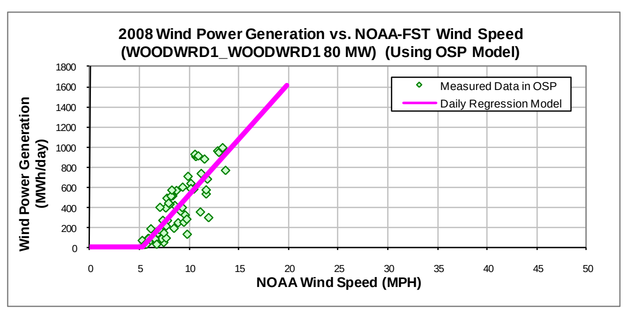


Figure 11-194: WOODWRD1_WOODWRD1 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-193: WOODWRD1_WOODWRD1 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-476.2732
Left Slope (MWh/mph-day)	97.6585
RMSE (MWh/day)	228.2191
R2	0.6973
CV-RMSE	36.5%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-589.7113
Left Slope (MWh/mph-day)	110.9574
RMSE (MWh/day)	165.9952
R2	0.6945
CV-RMSE	41.7%

Table 11-194: WOODWRD1_WOODWRD1 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	10.70	17,144	16,483	3.86%	31%	30%
Feb-08	28	11.15	17,879	17,160	4.02%	33%	32%
Mar-08	31	12.09	20,911	21,827	-4.38%	35%	37%
Apr-08	30	11.86	18,912	20,458	-8.17%	33%	36%
May-08	31	12.64	22,841	23,501	-2.89%	38%	39%
Jun-08	30	13.46	24,569	25,158	-2.39%	43%	44%
Jul-08	31	11.33	22,645	19,868	12.26%	38%	33%
Aug-08	29	8.58	9,266	10,510	-13.43%	17%	19%
Sep-08	29	8.23	7,794	9,435	-21.07%	14%	17%
Oct-08	30	10.72	16,473	17,109	-3.86%	29%	30%
Nov-08	30	9.17	13,666	12,588	7.89%	24%	22%
Dec-08	29	10.30	17,374	15,355	11.62%	31%	28%
Total	357	10.88	209,475	209,453	0.01%	31%	31%
Total in OSP (07/15-09/15)	60	8.90	23,865	23,860	0.02%	21%	21%

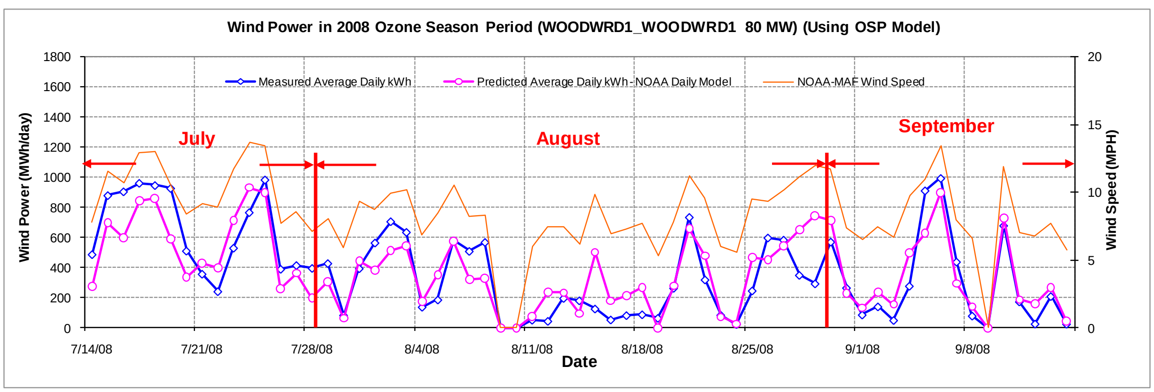


Figure 11-195: WOODWRD1_WOODWRD1 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

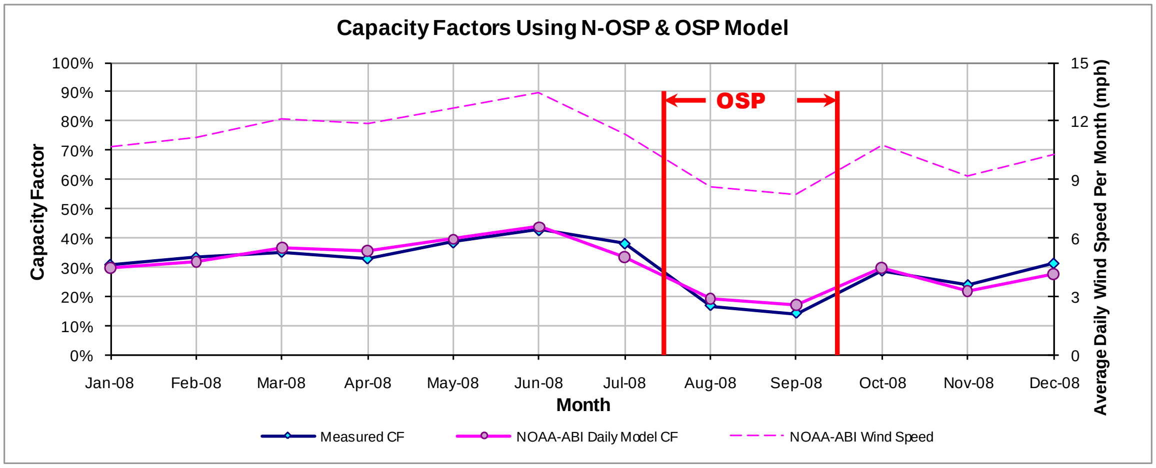


Figure 11-196: WOODWRD1_WOODWRD1 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-195: WOODWRD1_WOODWRD1 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
226,387	214,756	214,733

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
515	398	398

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.

11.48 Woodward Mountain Ranch (WOODWED2_WOODWRD2)

Table 11-196: Site Information for Woodward Mountain Ranch – WOODWRD2_WOODWRD2

GENSITECODE_ERCOT	Renewable Energy	City	County	Date in Service	Capacity (MW)	Company	Facility	Wind Turbine Information	Region	PCA	Interconnection	Weather Station	Remarks
WOODWRD2	WIND	McCamey	PECOS	Jul-01	80	FPL/Cielo/TXU	Woodward Mountain Ranch	Vestas V-47 (121)	ERCOT	AEP-West	WTU	FST	

SUBGENCODE_ERCOT	GENSITECODE_ERCOT	Capacity (MW)
WOODWRD2_WOODWRD2	WOODWRD2	80

11.48.1 Woodward Mountain Ranch – WOODWRD2_WOODWRD2

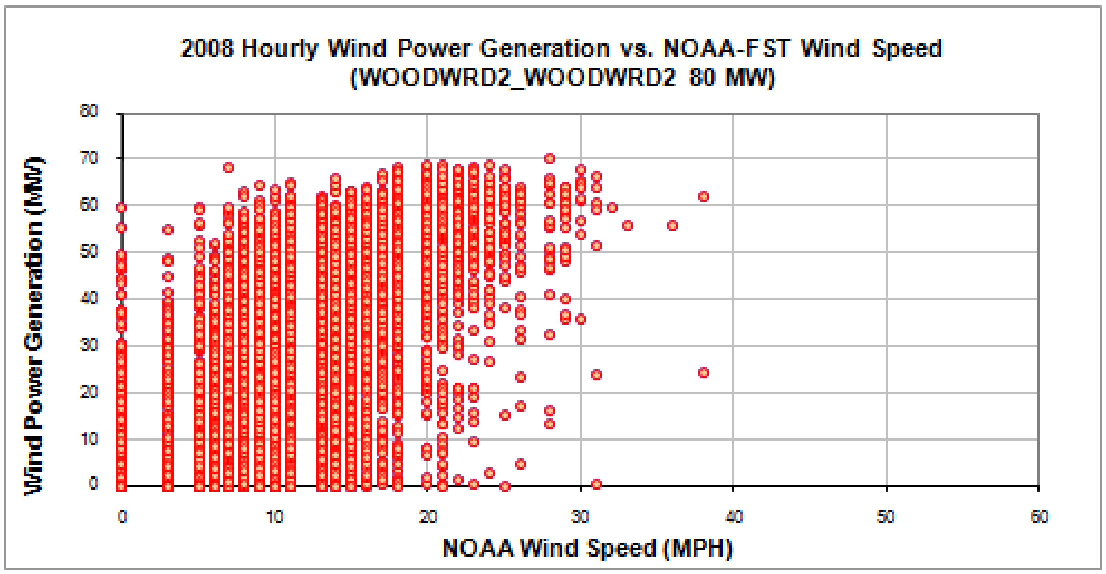


Figure 11-197: WOODWRD2_WOODWRD2 – Hourly Wind Power vs. NOAA Wind Speed (2008)

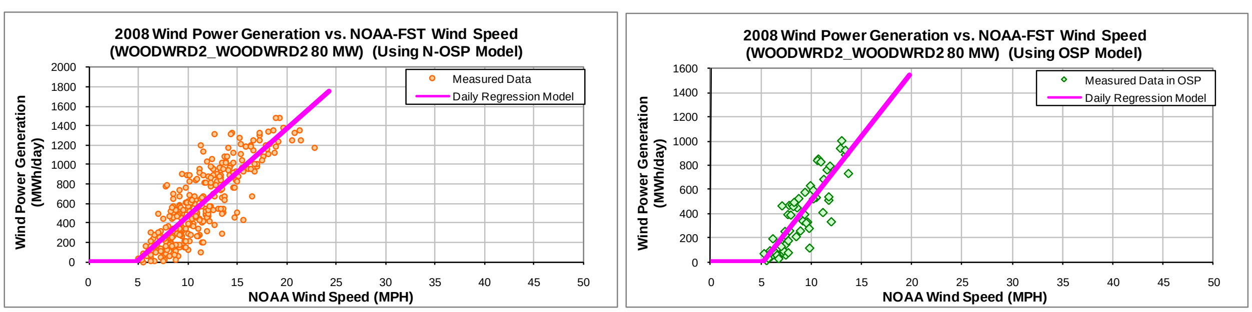


Figure 11-198: WOODWRD2_WOODWRD2 – Daily Wind Power vs. NOAA Wind Speed (Using OSP and Non-OSP Model)

Table 11-197: WOODWRD2_WOODWRD2 – Model Coefficients

Using Non-OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-427.6499
Left Slope (MWh/mph-day)	89.8569
RMSE (MWh/day)	203.9523
R2	0.7088
CV-RMSE	34.7%

Using OSP Model:

IMT Coefficients	NOAA Daily Model
Ycp (MWh/day)	-563.2036
Left Slope (MWh/mph-day)	106.6807
RMSE (MWh/day)	149.5528
R2	0.7214
CV-RMSE	38.7%

Table 11-198: WOODWRD2_WOODWRD2 – Comparison of Predicted Power vs. Measured Power

Month	No. Of Days	Average Daily Wind Speed (MPH) NOAA	Measured Power Generation (MWh) NOAA	Predicted Power Generation Using Daily Model (MWh) NOAA	Diff. NOAA	Measured Capacity Factor	Capacity Factor Using Daily Model NOAA
Jan-08	29	10.70	15,627	15,473	0.99%	28%	28%
Feb-08	28	11.15	16,172	16,085	0.54%	30%	30%
Mar-08	31	12.09	19,535	20,411	-4.48%	33%	34%
Apr-08	30	11.86	17,224	19,141	-11.13%	30%	33%
May-08	31	12.64	21,610	21,952	-1.58%	36%	37%
Jun-08	30	13.46	22,807	23,465	-2.89%	40%	41%
Jul-08	31	11.33	21,310	18,855	11.52%	36%	32%
Aug-08	29	8.58	9,030	10,212	-13.09%	16%	18%
Sep-08	28	8.29	7,572	8,934	-17.99%	14%	17%
Oct-08	30	10.72	16,187	16,059	0.79%	28%	28%
Nov-08	30	9.17	13,186	11,899	9.76%	23%	21%
Dec-08	29	10.30	16,685	14,435	13.49%	30%	26%
Total	356	10.89	196,946	196,923	0.01%	29%	29%
Total in OSP (07/15-09/15)	60	8.90	23,172	23,165	0.03%	20%	20%

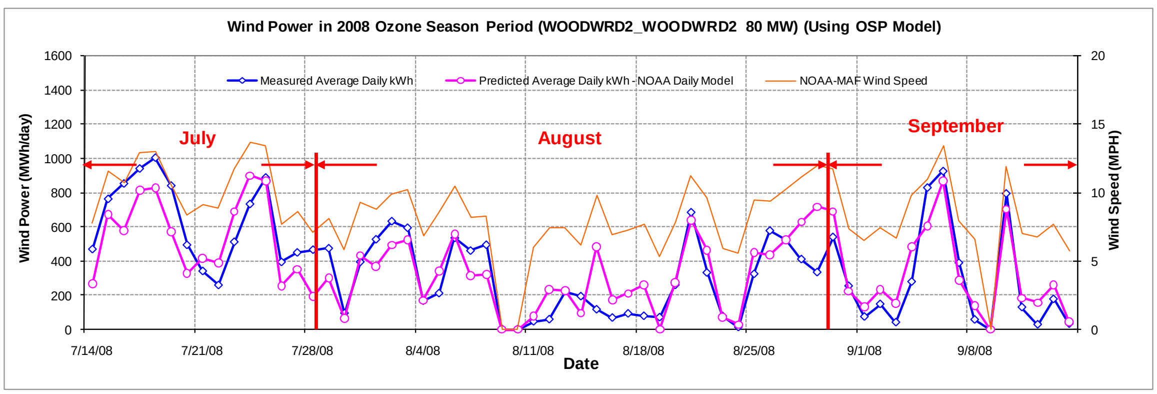


Figure 11-199: WOODWRD2_WOODWRD2 – Predicted Wind Power in OSP Using NOAA Wind Speed (2008)

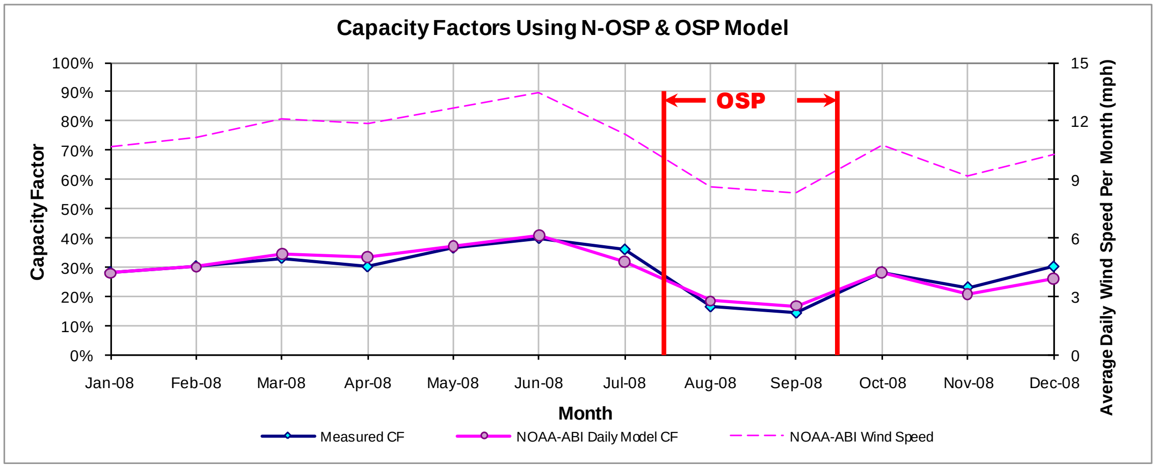


Figure 11-200: WOODWRD2_WOODWRD2 – Predicted Capacity Factors Using Daily Models (2008)

Table 11-199: WOODWRD2_WOODWRD2 – Predicted Power Production in 1999

Annual

1999 Estimated MWh/yr (2008 Daily Model)	2008 Measured MWh/yr for Modeling	2008 Predicted MWh/yr (2008 Daily Model)
213,031	202,478	202,455

OSD

1999 OSD Estimated MWh/day (2008 Daily Model)	2008 OSD Measured MWh/day for Modeling	2008 OSD Predicted MWh/day (2008 Daily Model)
499	386	386

Note: The 2008 Measured MWh/yr presented in the above table included only validated data and it was also adjusted to 366 days. Therefore, this number could be different from the original ERCOT data shown inTable 3-1.